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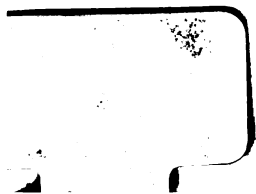
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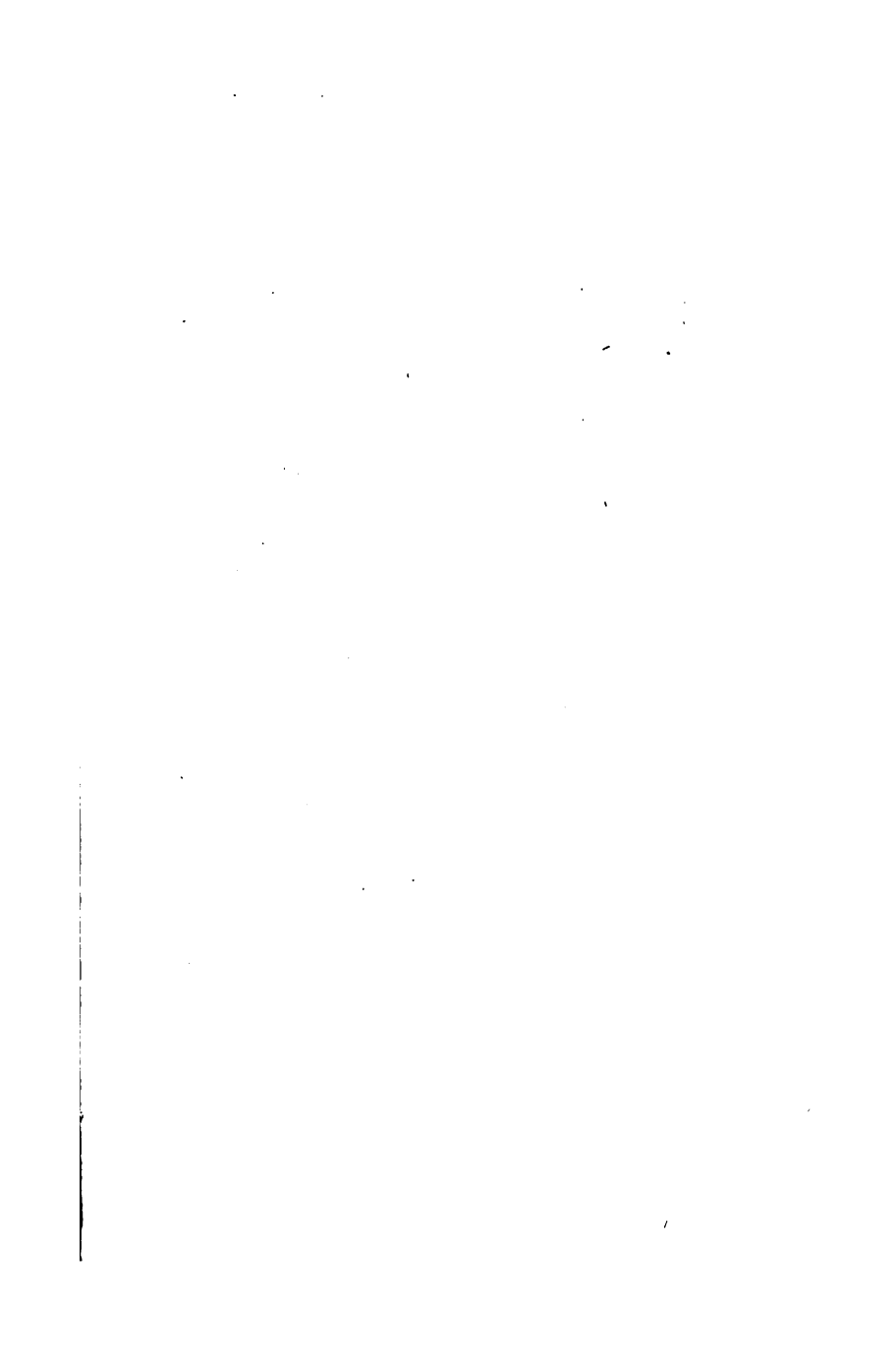
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W H S M.



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AN  
INTRODUCTION TO LOGIC:

REPRINTED FROM

*Our School Times,*

WITH

AN ADDITIONAL CHAPTER AND QUESTIONS

BY

THE AUTHOR.

EDITED BY

MAURICE C. HIME, M.A.,

EX-SCHOLAR AND MODERATOR, TRINITY COLLEGE, DUBLIN,  
HEAD MASTER OF FOYLE COLLEGE, LONDONDERRY.

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TO THE  
RIGHT REV. WILLIAM ALEXANDER, D.D.,  
THE LORD BISHOP OF DERRY AND RAPHAEL,

THIS  
*Introduction to Logic*  
IS RESPECTFULLY DEDICATED  
(WITH PERMISSION)

BY  
THE EDITOR.





## P R E F A C E.

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ALL the chapters of this book, except one, appeared originally in *Our School Times*, over the signature W. H. S. M. These are the initials of a name well known in Trinity College, Dublin—well known also to that not very numerous public which in the United Kingdom take an interest in Metaphysical speculation. In his own University W. H. S. M. held for several years the position of the most able and successful of the Honor Grinders in Logic, Ethics, and Metaphysics. His published contributions to the literature of the last-named science are of acknowledged value. The present INTRODUCTION TO LOGIC was a labour of love, suggested by the interest he took in the success of my School and of our little School-periodical. Logic is generally considered a dry subject, but I found that under his treatment it commended itself to some of my senior pupils and attracted the attention of some mature scholars who did us the honour to turn over our pages. Among these I may mention Dr. Moffett, President of the Queen's College, Galway, Professor of Logic in that College, and author of a valuable edition of Bacon's *Instauratio* ; also Dr. Shaw and Dr. Tarleton, Fellows of Trinity College and experienced Examiners and Lecturers of the Honor Classes in Logic in that University. The praise bestowed on the chapters of W. H. S. M. by

these and other competent judges has led me to publish the work and to anticipate for it a large circulation, as a substitute for or an elucidation of the text-books now in use.

There is a difficulty about introducing Logic into the list of subjects studied by schoolboys. They have already, it may be said, enough to occupy their hours of study, and Logic is a science which can be very conveniently deferred till they have entered a University. I agree with this opinion so far as it is intended to apply—namely, to those schoolboys who are preparing for a University career ; but for boys who are not burdened with Greek and Latin, or even for boys who are exempted from Greek alone, there is room, I think, for such an amount of Logic as this book imparts ; and as the business of drawing inferences is one that is incumbent on all of us every day of our lives, and is often liable to be performed erroneously, the science which teaches us how to draw them correctly seems fairly entitled to a place in an English school-education.

Archbishop Whately, who was a high authority on every branch of Education, wrote his *Easy Lessons in Reasoning* for the young men in the Marlborough-street Training Schools. He would certainly have approved of a work like this INTRODUCTION for the senior boys in the English department of our superior schools.

M. C. H.

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# LOGIC.

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## CHAPTER I.

### FORMS OF PROPOSITIONS.

Logic is perhaps the most unpopular of all the sciences. School-boys never think of learning it, and students at college generally content themselves with knowing enough for a pass—which means learning the meaning of a few barbarous names. Not one man in fifty deems it worth his while to become really acquainted with it, and when he does, the effects are not always such as to commend the study to others. Yet if we recollect that Logic is the science which teaches us what inferences we can make from the knowledge we already possess and how to discern between good and bad reasoning in any speech or book that comes in our way, it will be seen that there are few branches of knowledge which might prove of more practical utility if properly studied. And I believe the unpopularity of the science is not owing to the science itself but to the manner in which it has been treated of by writers on the subject. Had Logic been first worked into a scientific form by Euclid instead of Aristotle, its principles would probably be as well known as the Elements of Plane Geometry: while if the latter subject had to be learned from a treatise by Aristotle the triangle would be as much despised as the syllogism. Modern writers indeed have often abandoned Aristotle's mode of treatment but they have generally abandoned his science along with it. Mr. Mill's Logic, for example, is a book of which most of us have heard something. It is a useful book to read, chiefly because it contains a little of everything; but it consists of two bulky volumes extending to considerably over a thousand pages and costs twenty-five shillings, while all the Logic in the work (at least in the sense in which I use the term) could be easily compressed into a single chapter. In this paper and its successors I shall endeavour to explain what I regard as the fundamental principles of the science, and the reader will then be able to judge for himself whether it is worth studying further.

It is unavoidable for a writer on Logic to confine himself to the expression of thought in words, and therefore I shall not waste time in enquiring how far it is possible to reason without words.\* No word is admissible in reasoning (or indeed in any kind of composition) which has not a meaning, and the meaning of a word I shall, for shortness, term an *idea*. Whether the idea can exist without the word the Logician need neither know nor care. In order however to be able to reduce all assertions that can be made to a small number of forms we find it convenient in Logic to recognise certain parts of speech only, namely, nouns substantive, the verb *to be* with its various tenses, and a few particles, such as 'not,' 'if,' 'either,' "or," and "therefore," together with the words "All" and "Some." A pronoun we treat as a noun, and an adjective is regarded as part of a substantive (or as it is called a *term*), and verbs are regarded as made up of a substantive and the proper part of the verb *to be*. Thus, for example, if anyone asserts that *Every horned animal ruminates* (or chews its cud) we make *horned-animal* one term, and instead of the word *ruminates* we write *is a ruminant*. The advantage of this kind of reduction is as follows. We can often prove something or other to be true of all statements or assertions or *Propositions* (as we call them in Logic) which can be expressed in the form *A is B*. Now *Every horned animal is a ruminant* is of this form, while *Every horned animal ruminates* is not; and hence, though the two propositions have precisely the same meaning, the former is better suited for the purposes of Logic. Again, suppose the proposition had been *Every animal with horns on the skull ruminates*, we could write this in the form *Every animal-with-horns-on-the-skull is a ruminant*, which is of the same form as *Every A is B*. Sometimes a great number of words will enter into a single term in Logic. Thus, in the proposition *The infallibility of the Pope*, when speaking *ex cathedra* on the subject of faith or morals is a doctrine of the Church of Rome, we must make a single term out of "*The infallibility-of-the-Pope-when-speaking-ex-cathedra-on-the-subject-of-faith-or-morals*," while "*doctrine-of-the-Church-*

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\* Words, however, are generally and, I think, correctly described as the expression of thought, and thought must exist before it can be expressed. Language I believe was invented not to enable us to think, but to enable us to communicate our thoughts to each other.

of-Rome" is likewise a single term: and by this treatment the above proposition takes the form  $A$  is  $B$ . That it is sometimes troublesome to put the propositions or assertions we meet with in ordinary life into the forms recognised by Logic will surprise no one who has learned Algebra. Instead of asking the pupil to solve the equation  $x^2+5x+6=0$  the teacher often begins by saying that A man went to the fair and bought five sheep, &c., &c., in which question a great part of the difficulty consists in reducing the statement to one of the recognised forms of Algebraic equations.

Terms or Nouns Substantive—the only terms admitted in Logic—are either general or singular.\* Man, for example, is a general name because it applies to more than one individual: so is Member-of-parliament, Emperor-of-Rome, and many other expressions consisting of several words. But John Thompson is a singular term because it stands only for an individual, and so is The-First-Emperor-of-Rome, The-present-Member-for-Dundalk. The meaning of a general term is called a general idea, and that of a singular term might be called a singular idea. Logic is mainly concerned with general terms and ideas as it will be found that very little information can be conveyed without introducing them. Thus, if I say *Socrates was wise* (which for logical purposes we express *Socrates was a wise man*) the term *wise* is a general term because many other persons have been wise as well as Socrates. Indeed general terms are the only terms that, properly speaking, have a meaning. If I say of an individual before me that he is John Smith I really make no assertion about him, but if I say that he is wise or good, learned or stupid, rich or poor, &c., I make an assertion with a real meaning which gives the hearer some information beyond the mere name. Now, according to Logicians, all propositions can be reduced to one or other of the following three forms:—

$$\begin{array}{ll} A \text{ is } B & \\ \text{or} & \\ A \text{ is not } B & \} \quad (1) \\ \text{If } A \text{ is } B \text{ } C \text{ is } D. & (2) \\ \text{Either } A \text{ is } B \text{ or } C \text{ is } D & (3) \end{array}$$

---

\* Collective terms may be classed as singular for reasons which will be explained further on. The division of terms into general and singular is therefore sufficient for the purposes of Logic.



Of these (1) is called the Categorical, (2) the Hypothetical, and (3) the Disjunctive. The two latter are made up of two Categoricals (but the Disjunctive may contain more than two) joined by certain particles; and hence the Categorical must be treated of in the first place. As the meaning of a word is called an *Idea*, the meaning of a proposition is called a *Judgment*. Hence we often speak of Categorical, Hypothetical, and Disjunctive Judgments instead of Categorical, Hypothetical, and Disjunctive Propositions. But we find it necessary to increase the forms of Categorical Judgments. Our Proposition *A is B* may mean either *All A is B* or only *Some A is B*: and likewise *A is not B* may mean either *No A is B* (*i.e.* Every A is not B) or only *Some A is not B*. We must then state which we mean in order to be clearly understood, and thus we obtain four forms of Categorical Judgments or Propositions, viz:—

- |                 |     |
|-----------------|-----|
| All A is B      | (1) |
| Some A is B     | (2) |
| No A is B       | (3) |
| Some A is not B | (4) |

The first of these is often written *Every A is B* which expresses its meaning more clearly, and the second might perhaps be better written *Some As are Bs*. Thus we would say *Some animals are bipeds* rather than *Some animal is a biped*. Of these four propositions the first, which is called an Universal Affirmative, is usually denoted by the letter A: the second, which is called a Particular Affirmative, by the letter I: the third, which is called a Universal Negative, by the letter E; the fourth, which is called a Particular Negative, by the letter O. Thus the following argument:—

No A is B  
Some B is C  
Therefore Some C is not A

would be expressed by the letters EIO. Now Logicians maintain that all Categorical Propositions can be reduced to one of these four forms; for they must either affirm or deny, and the affirmation or denial must either embrace the whole subject spoken about or a part of it only. If the assertion is made about a singular term it is regarded as universal, for I cannot make any assertion about a part of an individual

without taking in the whole. Logicians also maintain that all statements or assertions whatsoever can be reduced either to one of these four Categorical forms (which we have called A, E, I and O.) or to the combinations of them which occur in the corresponding Hypotheticals and Disjunctives. Here the only proof of the pudding is in the eating. If you can make any statement which cannot be reduced to some one or other of these forms, the science is incomplete, though it may still be correct with regard to every assertion that can be reduced to these forms. However I do not think you will find any exceptions and I will therefore take it for granted that none is to be found. Now if we want to discover whether any given argument is good or bad, the first thing we have to do is to break it up into Propositions and reduce these Propositions to some of the forms I have mentioned; and when that is done Logic gives rules for determining whether the argument is good or bad. For instance, it lays down that the form EIO which I have already given, is always good provided there are no more than three terms employed in it. But the general rules for testing arguments must be deferred for another article.

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## CHAPTER II.

### ON COMPREHENSION AND EXTENSION AND ON ANALYTICAL AND SYNTHETICAL PROPOSITIONS.

GENERAL names, as already remarked, have a meaning, and this meaning can usually be resolved into parts. Thus, the name Triangle means a figure bounded by three lines, the name Parallelogram a figure bounded by four right lines, consisting of two pairs of parallels, and the name Man means an animal with two legs, no tail, and certain peculiarities of external form which I need not enumerate. The meaning of a general name or general term is called by Logicians its *Comprehension* or *Connotation*, or, occasionally, its *Intension*. The different parts of its meaning being usually called *Attributes*, the Comprehension or meaning of a name is often said to be a collection of Attributes. The terms Comprehension and Intension are often applied to Ideas as

well as to words, but in this case the phraseology is misleading. The Comprehension or Intension of an Idea is merely the Idea itself: but when the terms are employed it is implied that the Idea is a complex one which is divisible into parts, and when we speak of the Comprehension or Intension of the Idea these parts are supposed to be fully enumerated.\* A proposition in which the Comprehension of a name is set out at length in this manner is called a *Definition*. Thus A triangle is a figure bounded by three lines, is a Definition of the word Triangle. A definition ought to express all the parts of the meaning of the word defined and nothing more, and as the word Triangle is applied to a figure formed by three lines drawn on a sphere (which is termed a spherical triangle) it would not be a good definition to say A Triangle is a figure bounded by three *right* lines. That would be the definition not of a *Triangle* but of a *Rectilineal-Triangle*. The definition of a word is thus merely its meaning stated at length, and hence its comprehension, its intension, its connotation, and its definition are all different names for the same thing.

The Denotation or Extension of a term is the different individuals to whom it is applicable. Thus, the Denotation or Extension of the term Man is Julius Cæsar, the Duke of Wellington, John Smith, and all the other individual men that ever have been or ever will be in the world. It is a matter of accident whether a general name will have any extension or not. Unicorn, Griffin, and Dragon are general names because they have a meaning and we can suppose another world in which such beings exist; but the terms have no Extension, because there are no such animals in this world. If, therefore, we speak of the comprehension and extension of an idea in one breath we must not imagine that the two stand upon the same footing. Every idea (at least unless it is one which is not divisible into parts) must have a comprehension, for the comprehension is the idea itself; but the extension is a thing which the idea may or may not have, and if we want to discover whether it has an extension or not, we must not begin to reflect upon the

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\* It is more convenient, however, to use the terms Connotation, Comprehension, or Intension for the meaning of a word whether resolvable into parts or not. I accordingly use them in this sense.

idea in our minds but open our eyes and look about us. The word Dog has a meaning or comprehension. It means an animal with four legs and a tail, and other peculiarities of shape, &c. But if I want to find out whether it has an extension or not, no reflection on the idea of a Dog will tell me that. I walk down the next street and I meet a dog. That is the proof that the word has an extension. If I met a Unicorn, that term would have an extension also.

These terms give us a short way of expressing what is asserted in any proposition or judgment. Every Man is Rational, asserts that the comprehension or connotation of the term Rational belongs to all the individuals comprised in the extension or denotation of the term Man. Every equilateral triangle is equiangular, asserts that the comprehension or connotation of the term Equiangular is found in all the individuals comprised in the extension of the term Equilateral-triangle. But the extension of any term is determined by its comprehension. The extension of the term Man is simply the whole collection of individuals, present, past, and future, in which the comprehension of that term exists or will exist. The extension of the term Equilateral-triangle is simply the whole collection of individuals, past, present, and future, in which the comprehension of that term will be discovered. Any individual in whom the whole comprehension of the term man is not found is not a man. Any individual in which the whole comprehension of the term equilateral-triangle is not found is not an equilateral triangle. A proposition, therefore, always asserts that the comprehensions of two or more terms are or are not found together. Thus, All men are mortal, asserts that wherever the comprehension of the term man is found the comprehension of the term mortal will be found along with it. Some men are black, asserts that the comprehension of the term man is sometimes found along with the comprehension of the term black. No men are ruminants, asserts that the comprehension of the term man is never found along with the comprehension of the term ruminant, and so in all other cases.

This remark leads us to distinguish between two kinds of judgments or propositions which Kant has called Analytical and Synthetical. If the comprehension of one word *includes* that of another we can always assert with truth that the

comprehension of the latter will be found along with the comprehension of the former. Thus, the term *Man* means an Animal of a certain kind. The comprehension of the word *Man*, therefore, includes the comprehension of the term *Animal*, and we can assert with truth that the latter will always be found along with the former, or that *Every Man is an Animal*. Every affirmative proposition in which the meaning of the predicate (i.e., the latter term when the proposition is thrown into the form *A is B*) is a part of the meaning of the subject (or the first term when the proposition is thrown into the form *A is B*) is true,\* but it never conveys any information to the hearer. *The unicorn has a horn* is a true proposition. It explains a part of the meaning of the term *Unicorn*; but whether the information which it conveys is of any value the reader can judge for himself. These propositions in which the meaning of the predicate is a part of the meaning of the subject are called Analytical Propositions or Judgments. But there is another kind of Proposition in which the meaning of the predicate forms no part of the meaning of the subject. Such propositions may be either true or false, and, if true, they always convey real information when we hear them for the first time. Thus, *Every animal with horns on the skull is a ruminant*, conveys information to anyone who has not previously observed the habits of cattle, for the idea of an animal with horns on the skull is quite distinct from the idea of an animal that chews its cud. That every animal that possesses the one characteristic possesses the other is a fact which could not have been learned by any study of the meaning of words but only by actual observation. So that *The world revolves on its axis* could not be gathered from the meaning of the term *world*, but had to be inferred from observation of the heavenly bodies, and until recent times it was believed to be untrue. Propositions or Judgments of this kind are called Synthetical Propositions or Judgments. They, in fact, contain all our real knowledge. If we had nothing but analytical judgments, the only book that mankind would have need of would be a good dictionary, but in such a state

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\* Of course it is equally true if the predicate expresses the *whole* meaning of the subject whether in one word or several. This is the case with a definition, as already remarked.

no art or science could exist. There are, therefore, two kinds of Propositions, and the synthetical are of vastly greater importance than the analytical.

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## CHAPTER III.

### IMMEDIATE INFERENCES, CONVERSION, OBVERSION, AND OPPOSITION.

I HAVE already given the four forms of Categorical Propositions which are denoted by the first four vowels in the Alphabet. They are—

All A is B—denoted by the letter A	
Some A is B—	I
No A is B—	E
Some A is not B—	O

It frequently happens, however, that a writer or speaker avoids telling you distinctly whether he is speaking of All or Some. Thus when a man talks about The human race, The Irish people, &c., it is often very difficult to see which he means, and occasionally, perhaps, he does not know himself. In dealing with such statements when the reasoner's argument requires that he should have meant All it is better to give him credit for having meant it: if not assume that he only meant Some. If a man says A is B he *must* mean that Some A is B, but he need not mean that All A is so. Hence you are safe in assuming that he meant the one but not that he meant the other. I should here mention that *Some* and *All* are not intended to be exclusive of each other. If I say Some bodies are heavy I do not mean that the other bodies are not heavy; and in general in testing an argument you will do well to attend to what has been actually said, not what might have been said with truth.

Logicians divide Categorical propositions into three elements—a subject, a predicate, and a copula. The copula must always be *is* or *is not* (under which I include such expressions as *was* or *was not*, *will be* or *will not be*, &c.,) the former when the proposition is affirmative and the latter

when it is negative. In the four forms which I have given above, the letter A stands for the subject, and the letter B for the predicate. (My use of the letter A for the subject of a proposition will not, I hope, create any confusion with the use of the same letter to denote an universal affirmative proposition). The subject, in fact, is that about which an assertion is made, and the predicate is the assertion which is made about it. In ordinary language the subject is not always written before the predicate as it is in Logic. Thus in *Sweet are the uses of adversity*, the word *sweet* is evidently the predicate, and the Logical way of writing the proposition would be *The uses of adversity are sweet*. (You should gather from the context whether some or all of the uses was meant.) You will observe that the word *some* or *all* only occurs with the subject of the proposition. We never say All men are *all* rational animals or All men are *some* rational animals. But logicians have observed that the predicate has really a quantity though not expressed. If I say All men are mortal I plainly imply that Some mortals are men. There must be exactly as many mortals who are men as there are men who are mortals, and all men are included under this latter head. Some mortals must therefore be men, but it has not of course been asserted that all mortals are so. I have then made an assertion about some mortals but not about all mortals. Again if I say All men are rational animals it is clear that Some rational animals must be men; and though it may be true that All rational animals are so, I have not asserted it. My statement is quite consistent with the existence of rational parrots or rational monkeys. The same observation is true of such an assertion as Some men are black. Here there must be as many black things who are men as there are men who are black things; but of course there may be innumerable black things that are not men. These considerations have led logicians to lay down as a rule that *the predicate of an affirmative proposition is particular*. They have likewise laid down another rule that *the predicate of a negative proposition is universal*. For if No man is a stone be true, it must be equally true that No stone is a man; since if any stone was a man *that* man would be a stone, contrary to our original assertion. The same observation has been extended to a particular negative, but it might be

more correct to say that in that instance the predicate has no quantity at all. In the proposition Some men are not black you will not find any assertion made either about some black things or all black things. The *quantity* of a proposition means its universality or particularity, which again means the universality or particularity of *its subject*. The propositions A and E are *universal*, because in them we make assertions (affirmative or negative) about the *whole* of the subject, while I and O are *particular*, because we are asserting something of a *part* only, leaving the rest undetermined. The *quality* of a proposition means its affirmative or negative character. You will then understand what is meant by saying that the quantity of a proposition depends on (or is the same with) that of its subject, and that the quantity of the predicate depends on the quality of the proposition. It is sometimes said that the quantity of the subject depends on that of the proposition; but this is putting the cart before the horse.

Before finding what inferences can be drawn from two or more propositions it is desirable to see whether we can draw any inferences from a single one. Now I have already remarked that from any proposition of the form *All A is B* you can draw another of the form *Some B is A*. As many Bs in fact must be As as there are As which are Bs; and the former proposition tells us that all the As are so. This kind of inference is called *Conversion*. It will be seen that in it the term which was the original subject has now become the predicate and *vice versa*: so that *Conversion* means *inferring one proposition from another by transposing the terms*. From what has been said of the quantity of the predicate the reader will easily understand the following rules for Conversion laid down by logicians:

- A may be converted into I (1)
- I may be converted into I (2)
- E may be converted into E (3)
- O cannot be converted (4)

In the case of E and I we can get back to our original proposition by again converting the converse (as it is termed), but if we tried this on A we should find that we had dropped a part of our original assertion and only got back to I.



Examples may perhaps illustrate this kind of inference better.

ORIGINAL PROPOSITION (CONVERTEND.)	CONVERSE.
All men are mortal.	Some mortals are men. (1)
Some men are black.	Some black things are men. (2)
No men are green.	No green things are men. (3)
Some men are not black.	(No converse.) (4)

Again since the particular proposition Some A is B does not mean some *only*, whatever can be asserted of All can be equally asserted of Some. This gives rise to another kind of inference from a single proposition which is called *Subalternation*; it is only applicable to the Universal propositions A and E, and its rules are—

- A may be subalternated into I (1).  
E may be subalternated into O (2).

Examples—

ORIGINAL PROPOSITION.	SUBALTERN.
Every man is mortal.	Some men are mortal. (1)
No man is a ruminant.	Some men are not ruminants. (2)

The subaltern has the same subject and predicate with the original proposition, and differs only in having its subject particular instead of universal. No similar inference can be drawn from a particular proposition. Indeed it is self-evident that from any assertion about a part of a thing no inference can be drawn as to a different part, still less as to the whole.

Another kind of inference can be drawn from a proposition which is sometimes called *obversion*. It consists in turning an affirmative proposition into a negative, or a negative into an affirmative with the same meaning. If we allow ourselves to coin a term *not-A* or *non-A* corresponding to any positive term A this can always be done. Thus—

ORIGINAL PROPOSITION.	OBVERSE.
All A is B, is equivalent to	No A is non-B. (1)
Some A is B, „	Some A is not non-B. (2)
No A is B, „	All A is non-B. (3)
Some A is not B, „	Some A is non-B. (4)

The general rule is in affirmatives affix a *non* to the predicate and alter the copula; in negatives transfer the *not* or *non*

from the copula to the predicate. By this means A is reduced to E, I to O, E to A, and O to I. We often find the negative words ready to hand without any coining. Thus The Soul is not mortal (which logicians treat as E) is exactly equivalent to The Soul is immortal (which is regarded as A.) After obverting (or turning any proposition into the equivalent one of opposite quality) we can of course *convert* the obverse. This process is known by logicians as *Conversion by Contraposition*.

There is another peculiar kind of inference from a single proposition in which we argue from its truth not to the truth but to the falsehood of another or vice versa. This takes place in what is called *Contradiction*. Contradictory propositions have the same subject and predicate but differ both in quantity and quality: and it will be found that of any two such propositions one must always be true and the other false. There can of course be but two pairs of them, viz.: A and O, and E and I. To take the former as an example—

- |                  |     |
|------------------|-----|
| Every A is B.    | (1) |
| Some A is not B. | (2) |

it is clear that both cannot be true; for the As which are asserted not to be Bs in (2) must be included among the As which are asserted to be Bs in (1), that assertion being made of *all* the As. But neither can both be false, for it is obvious that if it is false that all the As *are* Bs, some at least of them are *not* Bs. The same thing is equally evident of E and I, and the reader if he chooses can fill in terms for himself and try the experiment. In general, the fundamental principles of Logic can only be established by an appeal to sound common sense. For if we attempt to *prove* them we must *reason*. And if any one denies the principles involved in all reasoning it is impossible to reason him into a belief in them—in other words, to prove them. But I think the reader who will try to realise to his own mind the meaning of the several propositions employed in these inferences will see that the conclusions drawn from them are self-evident—in fact that most of them only express the same meaning in other words.

Logicians generally include Contradiction along with what they term *Contrariety* and *Sub-contrariety* under the

general head of *Opposition*. All these inferences (if we are to call them so) are between propositions of opposite quality (i.e. one affirmative and the other negative) but with the same terms as subject and predicate. In Contrariety both are universal, and therefore one must be A and the other E, while in Sub-contrariety both are particular, whence they must be I and O. The inferences which can be made in this case are as follows: Two Contraries cannot both be true; therefore if we know one to be true we can conclude that the other is not true. This follows at once from what we have called Contradiction and Subalternation. If A, for example, be true, its subaltern I would be true, and the Contradictory of that subaltern E would be false; hence A and E cannot be both true. Two Sub-contraries on the other hand cannot both be false; hence if we know one to be false we can infer the truth of the other. This follows in the same way as before. If, for instance, I be false its Contradictory E is true, and therefore so is O which is the Subaltern of that Contradictory: hence I and O cannot both be false. The only useful kind of Opposition, however, is Contradiction. Since of two Contradictories one is always true and the other false, it is exactly the same thing to prove a proposition as to disprove its contradictory; and it is likewise the same thing to prove the Contradictory and to disprove the proposition. But for purposes of reasoning it is often more convenient to adopt one course than the other. Thus, in the Sixth Proposition of his First Book, Euclid establishes the proposition that if the base angles of a triangle are equal its sides are equal, by disproving its contradictory; and he establishes the Nineteenth as well as several other propositions in the same way. These instances will illustrate the use of Contradictory propositions in reasoning.

## CHAPTER IV.

## IMMEDIATE INFERENCES—CONCLUDED.

IN my last I enumerated the principal kinds of immediate inference, namely, Conversion, Subalternation, Obversion, and Opposition. All these inferences appeal to common sense and can hardly be established otherwise, but the reader will perhaps be in a better position to judge of their conclusiveness by seeing a collected list of them drawn out with examples such as we ordinarily meet with. Let us then see what inferences can be drawn in this manner from each of the propositions A, E, I, O, taken in order.

I. From A, taking as an example *All horned animals are cloven-footed*, we can infer the *truth of*

Some horned animals are cloven-footed—Subaltern (1)

Some cloven-footed animals are horned—Converse (2)

No horned animals are without cloven feet—Obverse (3)

No animals without cloven feet are horned—Converse

by contraposition (4)

and the *falsity of*

No horned animals are clovenfooted—Contrary (5)

Some horned animals are not clovenfooted—Contradictory (6)

to which we might add the converse of the Contrary.

(I have purposely made one or two slight alterations from the strict logical form in these inferences in order to show how the wording may be altered without affecting the meaning).

II. From the proposition E, or *No vertebrate animals are cold-blooded*, we obtain the following inferences:

Some vertebrate animals are not cold-blooded—Subaltern (1)

No cold-blooded animals are vertebrates—Converse (2)

All vertebrate animals are warm-blooded—Obverse (3)

Some warm-blooded animals are vertebrates—Converse by contraposition (4)

To which may be added

Some cold-blooded animals are not vertebrates—Subaltern of converse (5)

and we can infer the falsity of

All vertebrate animals are cold-blooded—Contrary (6)

Some vertebrate animals are cold-blooded—Contradictory (7)

To which might be added the converses of both contrary and contradictory.

III. From the proposition I, or *Some men are black*, we obtain the following inferences :

Some black things are men—Converse (1)

Some men are not non-black—Obverse (2)

(Here you will observe there is neither subaltern or converse by contraposition ; for we can only subalternate an universal proposition, while I is particular ; and the converse by contraposition being the converse of the obverse proposition there can be none where the obverse proposition is O as in this case.)

And we can infer the falsity of

No men are black—Contradictory (3)

with its converse : but there is here no contrary as contrariety only exists between universals.

IV. From the proposition O, or *Some men are not white* we can draw the following inferences :

Some men are non-white—Obverse. (1)

Some non-white things are men—Converse by Contraposition (2)

(The reader will see why there is no subaltern or converse.)

And we can infer the falsity of

All men are white—Contradictory (3)

To the inferences as to the falsity of other propositions I might have added the contradictory or contrary of the Obverse or of the converse by contraposition in each instance. The reader will notice that sub-contrariety does not occur in this list of inferences and in fact assuming the *truth* of any proposition, no inference whatever can be drawn from it by sub-contrariety. It is only if we assume it to be *false* that we can infer the truth of its sub-contrary. And here it might appear that I ought to have added to my table a list of the deductions which might have been made if the

original proposition was known to be false instead of true. But this is unnecessary for a reason already mentioned. To assume the falsity of any proposition is exactly the same thing as to assume the truth of its contradictory. If you wish then to know what inferences can be drawn from the falsity of the proposition A you will find them under the inferences from O regarded as true, and if you wish to find what inferences may be drawn from the falsity of E look to those deducible from the truth of I. The same rule applies to the falsity of O and I which are equivalent to the truth of A and E respectively. Hence no immediate inference is ever drawn by sub-contrariety, and that kind of opposition might have been wholly omitted—unless indeed to caution you as to what inferences *cannot* be drawn.

For you are to understand that our table is an *exclusive* table. You are warranted in drawing the inferences therein mentioned *and no others*. You are not to convert A into A. From *All men are mortal* you cannot infer that *All mortals are men*. Still less of course can you convert I into A; nor can you infer an affirmative converse from a negative proposition (except in obversion or contraposition) or *vice versa*. Again, an assertion may be true of a part without being true of the whole, and consequently there is no process corresponding to subalternation by which you can infer A from I or E from O. From *Some men are black* you cannot infer that *All men are black*: nor the reverse, for though the latter may be true it has not been asserted. From *Some men are not black* in like manner you cannot infer that *No men are black*. In fact there is a valuable general rule applicable to all these inferences, viz., that *you cannot increase the quantity of a term* (unless indeed you are inferring the falsehood instead of the truth of the proposition in which the term occurs with the larger quantity). For it is self-evident that something may be true of a part but not of the whole or of a different part of the same whole: and hence whenever a term is particular in the original proposition it cannot be universal in the inference derived from it. This rule which is expressed in the Latin phrase *Argumentum a particulari ad universale non valet* is as applicable to reasoning of any length as to immediate inferences, and any conclusion containing an assertion about a whole is invalid if the propositions from which it was drawn (no matter how many of them there may be) contain assertions about a part only. Another rule is

that if the same terms are preserved the quality of the proposition cannot be altered. This, again, is not applicable to cases in which from the truth of one proposition the falsity of another is inferred, and it is not inconsistent with what has been said of obversion and contraposition, because in them one of the terms is altered (B becoming non-B). This rule rests on the principle that in asserting one thing to be either wholly or partially identical with another we allege nothing as to their differences, and that in asserting them to be wholly or partially different we allege nothing as to their identity. The reader might here imagine that in alleging a partial identity we implied that there was a difference as to the other part; but in Logic *Some As are Bs* does not mean *Some As only are Bs*. It simply says that some As are Bs, leaving it quite undecided whether the other As are or are not Bs. The fact is that *Some As only are Bs* is not a single proposition but two propositions, viz., *Some As are Bs*, and, *Some As are not Bs*; and a similar observation will apply to some other forms which might be regarded at first sight as real additions to the four forms, A, E, I, and O, admitted by logicians. The two foregoing rules are of wide application. The latter, for example, precludes the drawing of a negative conclusion from any number of affirmative propositions.\*

There is another rule of still wider application involved in subalternation which is often expressed thus:—*Whatever is true of a whole is true of any part of the whole*. It would be better stated thus: *whatever is true of every member of a class is true of any member of any part of that class*. For there are some kinds of wholes whose properties do not belong to their parts. You cannot infer that because Ireland is an island the county Monaghan is an island, or that because all armies consist of infantry, cavalry, and artillery, a private soldier consists of infantry, cavalry, and artillery. I have altered the wording of the axiom to exclude this kind of wholes and parts, and also to call your attention to a fact which it is very important to bear in mind in logical reasoning, viz.,

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\* The rule as stated in the text is of course inapplicable to the case in which some of the propositions from which the conclusion is inferred are affirmative and others (or rather another) negative. It will be seen hereafter that in such cases the conclusion (if any) will be negative. It will also be seen that from two or more negative propositions no inference can be drawn.

that in all our four propositions *A, E, I, O*, the terms must be taken distributively not collectively. All men are rational, does not mean that all men taken collectively possess the attribute of reason, but that each individual man does so. Some men are white, does not mean that some men taken collectively are white (which would be true if these men were divisible into sets of three whose colours produced white when taken in conjunction), but that *each one of some men* is a white man. The language of logicians sometimes tends to conceal this fact: for not only are the terms All and Some ambiguous (as respects their distributive or collective use), but a term taken universally is often spoken of as *distributed* and a term taken particularly as *undistributed*. It is therefore necessary to remind you that a particular no less than an universal term is taken distributively not collectively. Whenever a term has to be used collectively it may be treated as a singular term. The British Army won the battle of Waterloo, is from the logician's point of view a singular proposition no less than The Duke of Wellington won the battle of Waterloo; The Parliament meets at Westminster, is as much a singular proposition as, The Queen resides at Balmoral. There is therefore no necessity for introducing new forms of propositions to meet the case of collective terms. *A, E, I*, and *O* are sufficient for all our needs; but if care be not taken we shall sometimes fall into what is called a fallacy of composition or division. Thus, if after enumerating the primary colours it was stated that All these colours make white, I would fall into the fallacy of division if I were to infer that Some of these colours make white; for the former proposition has not been asserted of *every* colour but only of all the colours collectively. This caution, too, will prevent you from confounding logical with algebraic reasoning, which are at first sight very much alike. Thus, *A* is *B* would be treated by some writers, even on Logic, as an *equation*, viz., Some *A*=Some *B*, and the conversion of this proposition would consist in merely writing down the same equation with its terms transposed, viz., Some *B*=Some *A*. In this reasoning it is forgotten that in Algebra the terms are always used collectively, but in Logic distributively. All armies=all soldiers, is a perfectly correct algebraic equation, but as no army is a soldier it is inadmissible in Logic, except, indeed, as a singular proposition of the same kind as, Hyde was Clarendon. I mentioned before



that logicians treated such singulars as universals ; but they cannot be dealt with as such in all respects. You cannot employ the terms Some A or Some B where A or B are proper names. To infer from Hyde was Clarendon that Some Hyde was Clarendon would be nonsense. Hence with such singulars there is no room for subalternation or contradiction, and the converse and contrary of a singular also possesses certain peculiarities—the latter in particular obeying the laws of contradiction ; for though Hyde was Clarendon and Hyde was not Clarendon would both be deemed universal propositions (A and E) in Logic, one must be false and the other true. It would occupy too much time to examine these peculiarities in detail, and they will be different when the subject or predicate only is singular and when both of them are so. I only mention them here because all the same peculiarities belong to collective propositions. From All soldiers are all armies, you cannot infer Some soldiers are armies—still less This soldier is an army.

In stating that the above list of immediate inferences is exclusive I only mean that it is so provided the same terms are preserved, or at least the original subject is preserved and the original predicate only altered by the addition of the *non* or *not*. If we allow ourselves to alter the terms in any way we choose many other immediate inferences may be drawn : for example, from John is the *father* of Thomas I may conclude that Thomas is the *son* of John. In fact from this point of view any proposition which expresses the same meaning, or part of the same meaning, with the original one may be regarded as an immediate inference from it, and the modes of expressing the same meaning in different words are often very numerous. No general rules however can be laid down for drawing such inferences. They depend chiefly on accidents of language and in particular on the number of synonymous words, which a dictionary would give more assistance in tracing than a treatise on Logic. However these reasonings can always be expressed as arguments from two or more propositions by supplying an additional proposition whose truth (though it will be self-evident) is essential to their validity. Thus in the instance I have given we might supply the hypothetical proposition If John is the father of Thomas, Thomas is the son of John, and thus form what is called a hypothetical syllogism. For logical purposes this is the best way

of treating all such inferences. It shows exactly what is requisite to make them valid. If the supplied premiss is a self-evident proposition, as in the instance just given, the inference is good; but if the proposition so supplied be not self-evident the reasoning is insufficient and the inference is not correctly down. For the purpose of testing arguments therefore it is better to regard no immediate inferences as valid except those which I have enumerated. In general it is a useful rule to require a reasoner to *state* every step in his argument; and if he does not state it himself you can make use of the rules of Logic to state it for him. In such cases you will very often find that the weak point of his argument does not lie in what he has said but what he has avoided saying, though it is equally essential to his case.

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## CHAPTER V.

### THE SYLLOGISM AND ITS RULES.

HAVING settled the inferences which may be drawn from a single categorical proposition we now come to those which can be drawn from two. I must here again remind you of what is meant by the comprehension and the extension of a term. The comprehension of a term is the number of attributes which it signifies, *e.g.* the comprehension of the term man is animality reason and a certain external form. The extension is the number of individuals which possess these attributes, *e.g.* in the case of man, Julius Cæsar, Tom Brown, and every one else whom you choose to name. Now an inference from two propositions is called a *sylllogism*, and when the two propositions are categorical the syllogism is called a categorical syllogism. All categorical syllogisms depend on the following axioms:—

1. If two terms coincide as to their extension with the same third term or with the same part of the same third term they coincide with each other.
2. If one of them coincides in its extension with a third term and the other does not coincide with it, the extensions of the two terms do not coincide.

To explain. When I say *All men are animals*, I say that the whole extension of the term man coincides with the extension of the term animal: but not that the whole extension of the term animal coincides with that of the term

man. (You will recollect that the predicate of an affirmative proposition is particular.) Again, if I say *No men are cold-blooded*, I say that no part of the extension of the term man coincides with the extension of the term cold-blooded. Thus generally an affirmative proposition states that the extensions of two terms coincide either in whole or in part and a negative proposition asserts that they do not coincide either in any part (universal negative) or in some part (particular negative). Taking the four propositions in order.

1. *All B is C*, asserts that the *whole* extension of B coincides with the extension of C (but not *vice versa*).

2. *Some B is C*, asserts that the extension of B coincides in part with that of C.

3. *No B is C*, asserts that no part of the extension of B coincides with any part of the extension of C.

4. *Some B is not C*, asserts that a part of the extension B does not coincide with any part of the extension of C.

Now when we compare the extension of our two terms with that of one and the same third in order to ascertain whether they do or do not coincide, the two terms are called the *extremes*, and the third, with which we compare them, is called the *middle* term. The two extremes afterwards receive names of their own. That which becomes *the predicate of the conclusion* is called the *major* term, and that which becomes *the subject of the conclusion* is called the *minor* term.

It is evident from what has been said that in every syllogism we must assume two propositions. We have in fact to compare the extension of the middle term with that of each of the extremes successively in order to see whether it coincides or does not coincide with each of them. The two propositions thus assumed are called *premisses*. The one in which the extension of the middle term is compared with that of the major term is called the *major premiss*, while that in which the extension of the middle term is compared with the extension of the minor term is called the *minor premiss*. Finally the proposition which is inferred from these two is called the *conclusion*. Every syllogism then consists of a major premiss, a minor premiss, and a conclusion. In the first the major term is compared with the middle to see whether they do or do not coincide in their extension: in

the second the minor term is compared with the middle to see whether they do or do not coincide in their extension ; and then the conclusion infers that the extensions of the major and minor terms do or do not coincide according as the premisses conform to the first or the second of the Axioms already laid down. Hence it follows that in every categorical syllogism there are three terms only, namely, the major, the minor, and the middle. There are likewise three propositions only, namely, the major premiss, the minor premiss, and the conclusion. In Logic the major premiss is usually written first, but the order is really a matter of indifference. The real distinction is this. The major premiss is that whose terms are the middle term and the predicate of the conclusion : the minor premiss is that whose terms are the minor term and the subject of the conclusion.

I now proceed to determine what *rules* can be deduced from our two *axioms*.

First, then, *the middle term cannot be taken twice particularly*. For if it were taken particularly in both premisses we should first have compared the extension of the major term with a part of the extension of the middle and then compared the extension of the minor term with a part of the extension of the middle. Now it is here possible that we might have compared them with different parts of the extension of the middle, in which case no conclusion could be drawn. Take for example the following argument :—

Every man is an animal—Major.

Every horse is an animal—Minor.

Therefore Every horse is a man—Conclusion.

The conclusion here does not follow ; for the term man only coincides in its extension with a part of the extension of the term animal, and the term horse likewise only coincides in its extension with a part (and a different part) of the extension of the term animal. Hence the terms man and horse have not been shown to coincide (as regards their extension) with the *same* third term, and therefore we can infer nothing as to their coincidence or non-coincidence with each other. The argument is simply worthless. But it would be otherwise if we had compared the extension of one extreme with the whole and that of the other extreme with a part of the extension of the third term. For the whole includes every part, and if in one premiss we compared

one extreme with the whole, and in the other premiss we compared the other extreme with a part, it is plain that we would have compared both extremes with the same part. Thus, the following is a valid syllogism.

All men are bipeds.

All bipeds are warm-blooded.

Therefore All men are warm-blooded.

Here, though man only coincides with biped in a part of its extension, yet as warm-blooded coincides with biped in its whole extension it must coincide with it in the same part that man coincides with: and as the two terms, man and warm-blooded coincide as regards their extension with the same part of the same third (biped) they must coincide with each other. A syllogism in which the middle term is taken twice particularly is said to have an *undistributed middle*. Accordingly it follows immediately from our axioms that a syllogism with an undistributed middle is invalid. This is our *first rule*. *The middle term must be taken universally once at least in the premisses.*

Again, if the extension of both extremes coincide whether in whole or in part with that of one and the same middle the conclusion is plainly that they coincide with each other not the reverse; and even if their extensions are shown to coincide with different parts of the same middle we cannot thence infer their non-coincidence with each other. Hence follows a *second rule, viz., that from two affirmative premisses a negative conclusion cannot follow*. There may be an affirmative conclusion or there may be no conclusion (the latter being the case if there is an undistributed middle) but there cannot be a negative conclusion.

Again, if the extension of one of the extremes coincides with that of the middle (whether wholly or in part) and that of the other extreme does not coincide with it, we can infer nothing as to the coincidence of the two extremes. There may be a conclusion asserting a non-coincidence, or there may be no conclusion, as will be the case if the middle term is undistributed; but a conclusion asserting coincidence cannot follow according to our axioms. Hence follows a *third rule*. *If any premiss be a negative there cannot be an affirmative conclusion.*

A *fourth rule* depends on the principle already laid down that an argument *a particulari ad universale* is invalid.

Hence, whether our premisses assert a coincidence or a non-coincidence of extensions, if we have spoken of a part only of the extension of either of the extremes in the premisses, our conclusion cannot contain an assertion about the whole extension of that extreme. This indeed is almost self-evident; for it seems manifest that the part of the extension of the extreme about which we have made no assertion may either agree or disagree with the other part of which alone we have said anything.\* Hence *No extreme which is particular in the premisses can be universal in the conclusion*. This fault is known by the name of *illicit process*. It is an illicit process of the major if the major term is particular in its premiss and universal in the conclusion and an illicit process of the minor if the same thing happens to the minor term. The fourth rule may therefore be expressed thus: *No syllogism is valid if an illicit process of either extreme occurs in it*.

A *fifth rule* is, *that from two negative premisses nothing follows*. For here neither of the extremes coincides in its extension with the middle, and in this case neither of our axioms (nor any other axiom that could be invented) tells us whether they agree or disagree with each other. Hence in this case we can draw no inference whatever.

From these five rules we can draw some useful consequences. First, there are always the same number of universal terms in the predicates of the premisses as in the predicate of the conclusion (which must be either 1 or 0). For since two negative premisses are inadmissible the predicates of the premisses cannot be *both* universal or contain *two* universal terms. If they contain *one*, then one premiss will be negative, whence the conclusion must be negative by our third rule and will therefore have an universal predicate; while if both predicates be particular in the premisses (*i.e.*, if both premisses be affirmative) the conclusion will also be affirmative and will therefore have a particular predicate. Secondly, by our first rule the middle term must be once at least universal in the premisses and it does not enter into the conclu-

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\* The reader must however bear in mind that a particular proposition is not limited to some *only* of the objects denoted by the subject-term. It merely abstains from making any assertion about *all*. It is therefore more accurate to say that there *may be* another part about which no assertion has been made than that there *is* one.

sion at all; while by the fourth rule no term can be universal in the conclusion unless it has been so in the premisses. Hence the premisses must contain one more universal term than the conclusion, and as this excess cannot occur in the predicates it must occur in the subjects. Hence, *if one premiss be particular (i.e., have a particular subject) the conclusion (if any) will be particular*. For from what has been said the premisses must have one more universal subject than the conclusion, and as in this case the premisses have but one universal subject the conclusion can have none—in other words, it must be particular. Further, *from two particular premisses no conclusion can be drawn*. For in every valid syllogism the premisses must have one more universal subject than the conclusion: but if both premisses be particular the premisses do not contain any universal subject, and therefore no conclusion is possible. It is likewise evident that *the premisses can never contain more than two universal terms in excess of the conclusion*; for as there can be no excess as respects the predicates the greatest possible excess will be attained when the subjects of both premisses are universal and the subject of the conclusion particular, i.e., when there are two universal premisses and a particular conclusion. Conversely *if the excess of universal terms in the premisses over the conclusion be two, we must have two universal premisses and a particular conclusion*. Some of these deductions are sometimes laid down as additional rules, but it is better to regard them as consequences of the foregoing five. These are the entire number of general rules, and it will be found on inspection that every syllogism which does not violate one or other of them is valid; but this fact is by no means obvious at first sight, and I can only hope that the succeeding papers will make it apparent.

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## CHAPTER VI.

### THE SYLLOGISM—NUMBER OF VALID MODES.

IN speaking of the number of terms in a syllogism there is an ambiguity which if not cleared up might render the various rules laid down in the last article almost unintelligible. The principle on which the entire theory depends is, that in reasoning, two terms are to be compared (as regards their extension) with the *same* third in the premisses, and from

thence their mutual relation to each other is to be inferred in the conclusion. Every legitimate syllogism, then, can have but *three* terms, namely, those which we have designated the major, the minor, and the middle. But in another sense the premisses of a syllogism contain *four* terms, each premiss having both a subject and predicate. The explanation of the ambiguity is of course that the middle term occurs *twice* in the premisses. The general rules laid down in the last article have gone upon the latter mode of the counting the number of terms. Thus if the middle term (which does not occur in the conclusion) was universal in both premisses we would have spoken of it as an instance in which the excess of universal terms in the premisses over those in the conclusion was two instead of one. The reader will have to bear this ambiguity constantly in mind.

The rules on which the validity of syllogisms depend having been laid down, the next step is to determine the varieties of valid and invalid syllogisms. Syllogisms differ in respect of figure and mode. The *figure* of a syllogism is determined by the position which the middle-term occupies in the premisses. If it is the subject of the major premiss and the predicate of the minor the figure is called the *first*; if the predicate of both premisses the *second*; if the subject of both the *third*; while if it is the predicate of the major and the subject of the minor the figure is the *fourth*. It is plain that no more than these four orders of terms is possible. The middle term as we have seen must occur in both premisses and when occurring it must be either predicate or the subject. Hence, taking the two premisses together the middle term must be either the predicate of both (2nd figure) the subject of both (3rd figure) or the predicate of one and the subject of the other (including both the first and the fourth figures). In this last case it *often* happens that we may treat the premisses as forming a syllogism in the first or the fourth figures indifferently, the conclusion being slightly varied in consequence. Thus being given the premisses

All men are bipeds,	(1)
Some long-lived animals are men,	(2)

we may either treat (1) as the major premiss and (2) as the minor and draw the conclusion,

Some long-lived animals are bipeds,



in the first figure ; or else treating (2) as the major, and (1) as the minor, we may form a syllogism in the 4th figure with the conclusion,

Some bipeds are long-lived animals.

This however is not invariably true. It will be seen hereafter that in some instances the premisses will give a conclusion in one of these figures but none in the other. For instance the premisses—

Some cloven-footed animals are ruminants, (1)  
No men are cloven-footed, (2)

will not warrant any conclusion if we treat (1) as the major premiss and (2) as the minor : but inverting this order we can draw the conclusion,

Some ruminants are not men,

by a syllogism in the fourth figure. The four figures are therefore really distinct.

The *mode* of a syllogism is a mere name for the three propositions that form it arranged in their order. In this order for the sake of uniformity the major premiss is written *first*—not of course that there is any reason for stating it first in an actual argument. The conclusion (which is written *last*) follows just as much from the premisses stated in one order as in the other, and the force of the reasoning often appears more obvious when the minor premiss is written first. It is necessary, however, to have some uniform order of writing them in Logic, in order that the various modes should have fixed names. In the names of these modes we make use of the vowels to denote the propositions as already explained. Thus the mode EIO means a syllogism in which the major premiss is E, (that is an universal negative) ; the minor premiss I, (that is a particular affirmative) ; and the conclusion O, (that is a particular negative). If we intended to make I the major, and E the minor, the mode would be called IEO. A mode therefore is always designated by three vowels the first of which stands for the major premiss, the second for the minor premiss, and the third for the conclusion. It is a valid or legitimate mode if the conclusion follows from the premisses, an invalid or illegitimate mode

if it does not. Thus in the above example it will be seen hereafter that EIO is a valid mode, and IEO is an invalid one. This may seem puzzling to the reader who has just been told that the conclusion equally follows from the premisses in whatever order they are written. And so it does : but the fact is that the two propositions here called O are not identical. They will be the simple converses of each other, and O does not admit of being simply converted. One of these O's follows from the premisses E and I, however written : the other does not follow from them however written.

Like most logical terms, however, the word "*mode*" also admits of an ambiguity. A mode, as I have described it, may be in any figure ; and the mode EIO is, in fact, a valid mode in each of the four. But it takes special names according to what figure it is in, and the word mode so applied comes to mean a combination of what I have previously called mode and figure. When mode is used in this latter sense it is no longer designated by three vowels only, but by three vowels in combination with certain consonants the meaning of which will be explained hereafter. Thus the mode EIO limited to the first figure is called FErIO, limited to the second figure it is called FEstInO, limited to the third figure FErIsOn, and limited to the fourth figure FrEsIsOn. Each of these four are spoken of as modes and referred to by their names. All valid modes have got names of this latter description, but the invalid modes have not ; and hence, in speaking of an invalid mode it is only from the context that you can learn in what sense the word *mode* is used. On the contrary, if a writer speaks of the mode EIO, it is plain he is using the word in the former sense : and if he speaks of the mode *Ferio* he is using it in the latter.

Now we wish to ascertain the total number of valid modes in both senses, but especially in the latter. Writers usually commence this inquiry by ascertaining the total number of possible modes valid and invalid. Now although the three propositions of a syllogism must be three distinct propositions, there is nothing to prevent the same letter standing for two, or even for all three of them. The mode AAA for example, means a mode in which the three propositions are all universal affirmatives which they may very well be and preserve their own distinctness notwithstanding.

Thus—

All animals are mortal;  
 All men are animals;  
 All men are mortal.

Hence, if we wish to find out the whole number of possible modes we must recollect that the major premiss may be any one of the four propositions A, E, I, O: so may the minor premiss, and so may the conclusion. The total number then, if we use the term mode, in the first sense is  $4 \times 4 \times 4 = 64$ . But each of these modes may (whether validly or otherwise) be in any one of the four figures, and hence if we wish to find the total number of possible modes in the second sense of the term we must multiply the previous result by 4 (the number of figures) which gives us 256. The total number of possible modes is therefore either 64 or 256 according to which sense we are using the word in.

But in ascertaining the number of valid modes our task will be much simplified if we confine our attention in the first place to the premisses, and using the term mode in the first sense before passing to the second. Here it is evident that the total number of possible pairs of premisses is 16 (any one of the four possible majors A, E, I, O, being followed by any one of the four possible minors). Let us set out the list:—

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Major	A	A	A	A	E	E	E	E	I	I	I	I	O	O	O	O
Minor	A	E	I	O	A	E	I	O	A	I	E	O	A	E	I	O

Testing these by the rules laid down in the last article we find that the pairs of premisses marked 6, 8, 14, and 16 in the above list are invalid according to the fifth rule for having two negative premisses. They cannot therefore lead to any conclusion in *any* figure. Again the pairs of premisses marked 10, 12, and 15 have two particular premisses, and therefore, according to one of the deductions given at the end of last article, no conclusion can be drawn from them in any figure.

The same thing can be proved, though not so immediately, of the pair of premisses IE (I being the major premiss). For since one premiss is negative the conclusion cannot be affirmative (rule 3). If there be any conclusion therefore

it is negative, and consequently has an universal predicate, *i.e.*, the major term is universal in it. But both terms of  $\Gamma$  being particular, the major term is particular in the major premiss, whether it is the predicate or the subject, and the syllogism (in whatever figure it is constructed) must thus contain the fault which we have termed an illicit process of the major, contrary to the fourth rule.

There remain then eight pairs of premisses. Of these three are affirmative, *viz.*, AA, AI, and IA, and the other five contain one affirmative and one negative premiss, *viz.*, AE, AO, EA, EI, and OA. The first three can only have one of the two affirmative conclusions A or I, while the last five can only have one of the two negative conclusions E or O. But we can restrict the number of valid conclusions still farther. For by one of the corollaries at the end of the last article it appeared that if one premiss of a syllogism be particular the conclusion (if any) must be particular. Hence, from the pairs of premisses AI and IA, the conclusion must be I, and from the pairs AO, EI and OA the conclusion must be O. From two universal premisses, however, a particular conclusion may be drawn, for, in fact, whenever an universal conclusion can be drawn, the corresponding particular follows at once from it by subalternation; and as the conclusion was drawn from the premisses, whatever can be drawn from *it* may be drawn from them also. The pair of premisses AA may therefore have either of the conclusions A or I, and the two pairs AE and EA may have either of the conclusions E or O. We thus obtain a complete list of legitimate or valid modes, using that term in the first sense. They are as follows (adopting the order in our table):—

AAA, AAI, AEE, AEO, AII, AOO, EAE, EAO, EIO, IAI, OAO,

in all eleven. It might be at first imagined that to find the number of legitimate modes in the second sense of the word we should multiply this result by 4, the number of the figures. But several modes are good in one figure and bad in others. For example, in the second figure the pair of premisses AA is bad for undistributed middle (rule 1) since in that figure the middle term is the predicate of both premisses, and if both are affirmative it is twice particular.

This investigation must be left for the next article. I

conclude this by stating what is meant by an *useless* mode. A mode is regarded as useless if a particular conclusion is drawn where the premisses warrant an universal one—or rather I should say an universal one with the same subject and predicate. The conclusion in such a case really does follow from the premisses (whereas in the case of an invalid or illegitimate mode it does not follow at all), but as the same premisses afford a more valuable conclusion it is considered useless to draw the less valuable one. Thus to take our former instance—

All animals are mortal ;  
All men are animals ;  
All men are mortal.

We might have equally concluded *Some men are mortal*; but for the reason already stated it is considered *useless* to do so. But if we draw a particular conclusion from the same premisses, treating the second premiss as the major (and thus forming the syllogism in the fourth figure instead of the first), the mode is not considered useless. The conclusion in this way is, *Some mortals are men*; and as the premisses do not enable us to infer that *All mortals are men*, the mode AAI of the fourth figure is not considered useless like AAI of the first. Many writers on Logic do not include useless modes in their list of legitimate modes, and in this way our catalogue of eleven becomes reducible to ten; for it will be seen hereafter that the mode AEO is useless in the two figures in which alone it is legitimate.

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## CHAPTER VII.

### SPECIAL RULES OF THE SYLLOGISM.

If we refer back to the general rules of syllogism, we shall find that some of the faults which they prohibit affect *terms* only, while others affect *propositions*; *e. g.*, that the middle term cannot be taken twice particularly, is a rule of the former kind, and that from two negative premisses nothing follows is one of the latter. Faults of this latter kind necessarily affect modes in all figures alike, as EEA is bad in any figure for having negative premisses; and consequently in

selecting our eleven valid modes in the last article, we have been able to exclude faults of this kind completely. But it is otherwise with faults of the former kind. Since the position of the terms is different in each figure, modes designated by the same vowels may be faulty in one figure and valid in another. Thus the mode AAA is invalid in the second figure, because the middle term is taken twice particularly (or it has what is called an undistributed middle) while in the other three figures this fault is avoided. But in the third and fourth figures it has another fault, namely, that the minor term (being the predicate of an affirmative proposition) is particular in the premiss while it is universal in the conclusion—a fault which we described as illicit process of the minor. Hence this mode is valid in the first figure only. If then we wish to ascertain what modes are valid in each figure, we must turn to the general rules and see how many of them affect *terms* not propositions, and then try how many of our ten (or rather eleven) valid modes comply with these rules in each figure.

The rules which affect terms not propositions are (1), *the middle must not be twice taken particularly*, and (2), *no term can be particular in the premiss and universal in the conclusion*. The fault occasioned by violating the first of these rules is called *undistributed middle*, and that occasioned by violating the second is called *illicit process* of the *major*, or of the *minor*, according to which term it occurs with. The three faults, therefore, which may affect a mode in one figure while not affecting the same mode in a different figure, are (1), undistributed middle, (2), illicit process of the major, and (3) illicit process of the minor. The *special rules of syllogism*, as they have been called, are simply rules for avoiding these faults, and they will necessarily be different in each figure, owing to the different position of the terms.

1. Take the first figure. An illicit process of the minor term cannot occur in any of our eleven selected modes, for here (and in the second figure) the minor term is the subject of the minor premiss as well as of the conclusion, and an illicit process of the minor would require a particular minor premiss and an universal conclusion. But we require a special rule to guard against an illicit process of the major. The major term in this figure (as also in the third) is the

predicate of both major premiss and conclusion. There will be an illicit process if it is particular in the former case and universal in the latter, i.e., if the major premiss be affirmative and the conclusion negative. But to have a negative conclusion from an affirmative major premiss it is clear that the minor premiss must be the negative, and *vice versa* if the minor is negative the major is affirmative and the conclusion negative. Hence the special rule to avoid illicit process of the major in the first figure (and also in the third) is *the minor must not be negative*, or *the minor must be affirmative*. We still require another special rule to exclude undistributed middle. The middle term in the first figure is the predicate of the minor premiss, and that premiss we have seen is affirmative. Hence the middle term must be universal in the major premiss to avoid an undistributed middle, and since (in the first figure) it is the subject of the major premiss the second special rule emerges, viz., *the major must be universal*. If then we want a list of the modes which are valid in the first figure, we go back to our original eleven and select those only which have an affirmative minor and an universal major, and thus we obtain AAA, AAI, AII, EAE, EAO, EIO. All these are valid; but two AAI and EAO are evidently useless since we can draw the conclusions A and E from the same premisses instead of I and O.

2. Coming to the second figure an illicit process of the minor, as has been remarked, is already excluded. But there will be an undistributed middle unless one premiss be negative, and (since the negative premiss necessarily involves a negative conclusion) there will be an illicit process of the major, unless the major premiss be universal. Hence the two special rules of the second figure are *one premiss (and the conclusion) must be negative*, and *the major premiss must be universal*. Six again of the selected modes answer these tests, viz.,—EAE, EAO, AEE, AEO, EIO, OAO, all of which are legitimate, but EAO and AEO are useless, inasmuch as the conclusion E can be drawn from the same premisses.

3. Take the third figure. We have already seen that to avoid an illicit process of the major *there must be an affirmative minor*. But in this figure the minor term is the predicate of this affirmative minor premiss, and therefore, particular. Hence, to escape an illicit process of the minor, that term

must be particular in the conclusion also, *i.e.*, *the conclusion must be particular*. But here none of the selected eleven can have an undistributed middle; for the middle term being the subject of both premisses cannot be undistributed unless both are particular. Applying our two rules, we again find six valid modes—AAI, EAO, AII, IAI, EIO, and OAO. None of these are useless, because no premisses can lead to an universal conclusion in this figure.

4. Lastly, the fourth figure admits of all three faults within our selected modes, and, therefore, we require three special rules (one directed against each) to avoid them. Since the middle term is here the predicate of the major premiss, and the subject of the minor, there will be an undistributed middle if the major be affirmative *and* the minor particular; and hence emerges our first rule which may be stated in either of the following ways:—*If the major is affirmative the minor is universal*; or, *if the minor is particular, the major is negative*. The major term is here the subject of the major premiss. Hence there will be an illicit process of that term if the major premiss is particular *and* the conclusion negative, and so we reach the second rule which may be expressed either as *in negative modes the major is universal*; or, *if the major be particular the mode is affirmative*. Finally, the minor term being the predicate of the minor premiss, if that premiss is affirmative, the conclusion cannot be universal without introducing an illicit process of the minor. Hence the third rule, *if the minor be affirmative the conclusion is particular*; or, *if the conclusion be universal the minor is negative*. Applying these three restrictions to the selected modes, we find the following six are left:—AAI, AEE, AEO, IAI, EAO, EIO; but here AEO is useless, since AEE is legitimate in this figure; and the same thing occurred in the second figure, which was the only other one in which AEO proved to be legitimate, so that we may lay this mode aside as being in all cases either illegitimate or useless.

Logicians have given special names to the valid modes of each figure which, preserving the vowels as before, introduce consonants which distinguish the one from the other. Thus the four useful modes of the first figure are called Barbara (perhaps the meaning would be clearer if it was written bArbArA), Celarent, Darii, and Ferio (the two use-



less ones AAI and EAO, have got no such special names). The four useful modes of the second figure are called Cesare, Camestres, Festino, and Baroko: the six modes of the third figure are called Darapti, Felapton, Disamis, Datisi, Bokardo, and Ferison: the five useful modes of the fourth figure are called Bramantip, Camenes, Dimaris, Fesapo, and Fresison. These names have meanings which it may be as well briefly to explain. Aristotle, the founder of Logic, regarded a valid syllogism in the first figure as possessing a self-evidence which the valid syllogisms in the other figures did not possess. In fact, a syllogism in the first figure, with an *universal* major (relating to a *whole* class) and an *affirmative* minor (*including* something in that class) is but a special example of the Aristotelian Dictum, which states the self-evident truth already stated in other terms that—

Whatever may be affirmed or denied of a whole class,  
In which class something else is included,  
May be affirmed or denied of that something else;

(the three parts of the Dictum, as above stated, corresponding to the major premiss, minor premiss, and conclusion respectively); but valid syllogisms in the other figures do not fall so readily under any similar principle. Aristotle proposed to prove their validity in this way. If I take a syllogism in the second figure (suppose) and show that *from the same premisses*—employing no process whose validity is open to any doubt—I can deduce the same conclusion by a syllogism in the first figure, I prove this syllogism in the second figure to have been valid. For this purpose the processes employed (if we omit the reductions of Baroko and Bokardo, which were of a round-about and troublesome character) were two in number, viz., *conversion*, whose validity we have already seen, and *transposition of the premisses*, i.e., turning the major premiss into a minor, and the minor into a major. The validity of the last process is evident, for if the premisses are true when stated in one order, they must be equally true when stated in the other. If, however, the premisses are transposed, the new conclusion will not be identical with the old one, for the minor term of the transposed syllogism (i.e., the former major) will be its subject, and the former minor its predicate. But, says Aristotle, it may be *converted* into

the old conclusion, and thus the validity of the old syllogism is proved. Hence conversion and transposition are the only processes employed, but we may have to convert the new conclusion as well as one or both of the old premisses. Now, the names of the modes of the first figure above given are (with the exception of the vowels) insignificant; but it is otherwise with those of the second, third, and fourth. These names indicate to what mode of the first figure they can be reduced, and how the reduction is to be effected. The first letter means that they are reducible to the mode of the first figure which begins with that letter, *e.g.*, Bramantip to Barbara, Darapti to Darii, Cesare to Celarent. *S* stands for simple conversion and *p* for conversion *per accidens*, and they are placed immediately *after* the vowel standing for the premiss which is to be converted; but if the new conclusion is to be converted, then the *s* or *p* forms the last letter of the name. Finally, *m* indicates that the premisses are to be transposed for the purposes of reduction. The reader will, perhaps, find some amusement in working out these reductions, but on the principles we have laid down they become unnecessary.\*

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## CHAPTER VIII.

### SORITES AND HYPOTHETIC AND DISJUNCTIVE SYLLOGISMS.

WE have now got a complete scheme or table of all valid arguments in which a conclusion is drawn from two categorical premisses; and longer reasonings can be reduced to a series of syllogisms, and their legitimacy or illegitimacy ultimately

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\*The name Bramantip will probably suggest to the reader the question, How can the conclusion I be converted *per accidens*? Recollecting, however (as the letter *m* reminds us), that the premisses are transposed, the letter *p* indicates that the *new* conclusion is to be converted *per accidens* in order to arrive at the old conclusion I. The new conclusion, therefore, is not I but a proposition which can be converted *per accidens* into I, *i.e.*, it is A.

tested by the same table. Thus, if we had an argument of the following form :—

All B is C	}	We can make of it these three Syllogisms—
All C is D		
All D is E		
All E is F		
Therefore All B is F		

1	2	3
All C is D	All D is E	All E is F
All B is C	All B is D	All B is E
∴ All B is D	∴ All B is E	∴ All B is F

Such an argument is called a *Sorites*, and the one before us is a valid argument, since we can derive the same conclusion from the same premisses by three syllogisms in *Barbara*. Logicians have, however, discovered means of testing the validity of a *Sorites* directly, and thus dispensing with its reduction to a series of syllogisms. In the *Sorites* it will be observed that the subject of each proposition (except the conclusion or last proposition) is the predicate of the preceding one, and that the conclusion affirms the predicate of the second last of the subject of the first. The rules for an argument so constructed are that *no proposition previous to the second last can be negative, and no proposition intermediate between the first and last can be particular*. These rules correspond to those of the first figure that the minor premiss cannot be negative nor the major particular; for it will be observed that the *second* proposition of the *Sorites* is the major of the first syllogism, the first proposition being the minor of the same. The *Sorites* can also be brought under a dictum corresponding to that of Aristotle, viz. :— Whatever may be affirmed or denied of a whole class may be affirmed or denied of anything that is wholly included in a third thing, which third thing is wholly included in the class,—adding, of course, a fourth, fifth, or sixth thing, if the number of propositions in the *Sorites* be five, six, or seven, &c. The stress of the argument lies on the total inclusion of each of the terms in the preceding one, and hence all the propositions except the first and last will be universal affirmatives (for a negative asserts an *exclusion* not an inclusion).

But there are other kinds of reasoning which seem to escape our rules altogether, namely, those which proceed from hypothetical or disjunctive premisses. For instance

If the barometer falls it will rain,  
The barometer is falling,  
Therefore it will rain.

But if we recollect that a term in Logic may include many words, we shall see that such reasonings can be brought under the same principles as any other. The major premiss is here equivalent to *All-cases-in-which-the-barometer-falls are cases-in-which-it-is-about-to-rain*. The minor premiss may be written, *The present case is a case-in-which-the-barometer-falls*, and conclusion will be, *The present case is a case-in-which-it-is-about-to-rain*. This is a syllogism in Barbara; for the singular proposition, *The present case is a case-in-which-the-barometer-falls*, may be treated as an universal. But if we once settle under what conditions hypothetical reasonings are valid, we may dispense with this awkward reduction in individual instances; and this can be easily done. From the hypothetical proposition, *If B is C then D is F*, there appear to be only four possible ways of arguing, viz :—

1	2	3	4
If B is C, D is F	If B is C, D is F	If B is C, D is F	If B is C, D is F
B is C	D is F	B is not C	D is not F
∴ D is F	∴ B is C	∴ D is not F	∴ B is not C

Turning these into categorical syllogisms in the way already indicated we obtain—

(1)  
Every case of B being C is a case of D being F.  
Every possible case is a case of B being C.  
∴ Every possible case is a case of D being F.

This is a good syllogism in Barbara, the terms being, *major*, case-of-D-being-F, *minor* possible case, *middle* case-of-B-being-C. Hence in hypothetical syllogisms it is *legitimate to argue from the affirmation of the antecedent to the affirmation of the consequent*. (It is hardly necessary to say that in

the proposition, If B is C, D is F, the antecedent is B is C and the consequent D is F.)

(2)

Every case of B being C is a case of D being F.

Every possible case is a case of D being F.

∴ Every possible case is a case of B being C.

This syllogism is in the second figure and is invalid for undistributed middle, the middle term being case-of-D-being-F. Hence in hypothetical syllogisms *it is not legitimate to argue from the affirmation of the consequent to the affirmation of the antecedent.*

(3)

Every case of B being C is a case of D being F.

No possible case is a case of B being C.

∴ No possible case is a case of D being F.

A syllogism in the first figure with a negative minor and therefore invalid for an illicit process of the major term, viz.:—case-of-D-being-F. Hence *it is not legitimate to argue from the denial of the antecedent to the denial of the consequent.*

(4)

Every case of B being C is a case of D being F.

No possible case is a case of D being F.

∴ No possible case is a case of B being C.

This is a good syllogism in Camestres of the second figure, the middle term being case-of-D-being-F. Hence *it is legitimate to argue from the denial of the consequent to the denial of the antecedent.*

These are the four laws of hypothetical reasoning. It will be seen that a hypothetical proposition is always the equivalent of an universal affirmative which simplifies its rules considerably. Occasionally, however, the hypothesis is carried on further; e.g.,

If B is C, D is F.

If D is F, G is H.

∴ If B is C, G is H.

This is a valid syllogism in Barbara according to the above system of reduction, and can be brought under one of

the foregoing rules by a slight amendment, viz.:—*It is leitimate to argue from the (hypothetical) affirmation of the antecedent to the affirmation of the consequent (on the same hypothesis).* This takes in the above syllogism considering *If D is F, G is H*, as the proposition reasoned from. *Its* antecedent (D is F) is affirmed on the hypothesis that B is C; therefore, *its* consequent (G is H) may be affirmed on the same hypothesis.

Another kind of proposition apparently excluded from our rules, is that known as disjunctive, such as—Either the Gospels are a pure fabrication, or miracles were wrought by Jesus Christ. But propositions of this kind can be very easily put into the hypothetical shape, and the rules last arrived at applied to them. The proposition given above is the precise equivalent of either of the following:—If the Gospels are not a pure fabrication, miracles were wrought by Jesus Christ, or If Jesus Christ did not work miracles the Gospels are a pure fabrication.\* Logicians, however, generally admit the validity of the following inference:—

Either B is C or D is F.

D is F.

∴ B is not C.

If we put this into the hypothetical form and then reduce it we obtain

Every case of B not being C is a case of D being F.

Every possible case is a case of D being F.

∴ Every possible case is a case of B not being C.

which is plainly bad for undistributed middle. But it has been supposed that a proposition of the form—*Either B is C or D is F* implies that the two propositions B is C and D is F cannot *both* be true, and if so, the above disjunctive reasoning would be correct. But though the speaker may often intend to imply by the words “either—or” that both alternatives cannot be simultaneously true, the words do not necessarily imply it, and therefore it seems to me that this mode of reasoning is invalid. If the words “either—or” however, necessarily imply mutual exclusiveness the disjunctive proposition is equivalent to two hypotheticals—

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\* These hypotheticals are not two distinct propositions, being, in fact, the converses (by contraposition) of each other. They convey exactly the same meaning.

viz. : If B is not C, D is F, and If B is C, D is not F; and it is the second of these hypotheticals that forms the major premiss of the reasoning in question—viz. :

Every case of B being C is a case of D not being F.

No possible case is a case of D not being F.

∴ No possible case is a case of B being C.

which is a good syllogism in Camestres provided its major premiss is really implied by the disjunctive proposition, Either B is C or D is F. There are, of course, other varieties of hypotheticals and disjunctives, such as for example —If B is C either D is F or C is H, but they do not require special treatment.

Another variety of the hypothetical syllogism is what is known as an *enthymeme*,\* in which the conclusion is apparently drawn from a single proposition, the additional premiss (which is not expressed in terms) being, If the (expressed) premiss is true the conclusion follows. Thus, if I argue, This country is distressed, therefore it is under a tyranny, the full reasoning plainly is: If this country is distressed it is under a tyranny; but it is distressed; therefore it is under a tyranny. We can often simplify such reasonings by supplying a categorical premiss instead of a hypothetical. Thus, if the argument was, Every animal has a nervous system, therefore Every man has a nervous system it is pretty plain that Every man is an animal, is the link to be supplied. This cannot always be done however, and one of the commonest modes of misrepresenting an enthymematic argument is to fill up the links categorically where such was not the reasoner's intention. For instance, one of the arguments employed against the great antiquity of the Homeric poems is that no early imitations of them exist. I have seen this enthymematic reasoning filled up by an opponent thus: Every poet imitates the writings of every preceding poet—as if that was the only condition on which Homer would have found imitators. It may be remarked that in an argumentative treatise the author very rarely expresses *all* his premisses, and to judge accurately of the reasoning you should be very careful as to the wording of

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\* Aristotle uses the word *Enthymeme* differently, but his distinction is useless in Logic and therefore not worth preserving.

the premisses which have to be supplied. What a writer *says* is often misrepresented, but it is still more common to misrepresent what he does not say but implies.

Other ways of expressing propositions will readily occur to the reader. For example a question is very often asked where the real premiss on which the following reasoning depends, is the supposed answer to it. In dealing with such an argument logically, we must treat this supposed answer as the real premiss. So, an exclamation or sentence terminating with a note of admiration often forms a premiss in reasoning, and we must here also supply its logical equivalent, if we wish to test the reasoning. Sometimes, too, an adjective or epithet in a sentence can be developed into a proposition, and one on which the train of reasoning depends. When a recourse is had to ridicule, the real premiss (or rather reasoning) is, This doctrine is ridiculous, and therefore untrue. Logic can lay down no general rules for reducing the ordinary modes of expression to logical forms. The reader must do that for himself, and it is only when he has done it that Logic can tell him whether the reasoning is good or bad. But for this purpose it is by no means necessary to reduce the reasonings in question to a series of syllogisms. It is never necessary to go beyond the reduction to a Sorites, the rules for which have been given in this article; and it is frequently not necessary to go so far.

We have now obtained an exhaustive enumeration of all species of good reasoning, and I think it may be safely laid down that any argument that cannot be reduced to one or other of them is invalid. Take care, however, before saying that an argument cannot be so reduced, to ascertain whether it is expressed *in full*: for enthymemes are very common, and when the unexpressed premiss is some very obvious truism, we are apt to forget that anything is left unexpressed. For example an argument of this form—

$$\begin{array}{l} \frac{3}{4} \text{ of the army were killed,} \\ \frac{1}{4} \text{ of the army were Prussians,} \\ \therefore \text{Some of the Prussians were killed,} \end{array}$$

is logically incomplete, and to complete it we must state in terms that any two fractions of the same whole, each amounting to  $\frac{3}{4}$  (or to over one-half) must have a common part—a truth so obvious that few persons would think it necessary



to state it, but which, nevertheless, is taught by arithmetic, not by logic. This would become evident, if we introduced fractions of a more complicated character, when the reader would probably find it necessary to work out a sum in arithmetic before he could determine whether the conclusion followed from the premisses or not. On supplying the arithmetical premiss or premisses the argument becomes logically valid, and the appearance of an undistributed middle is removed. In fact, all *completed* reasonings whether good or bad can be thrown into logical form, the only difference being that good reasoning will fall into some of the valid modes, and bad reasoning into some of the invalid ones. But we may reason rightly from false premisses, and *vice versa*; and the conclusion is not proved unless the reasoning is valid *and* the premisses true. If the first requirement is fulfilled it is usually desirable to look to the second.

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## CHAPTER IX.

### FALLACIES.

IT is no easy task to treat of Fallacies within a moderate compass, especially as writers on Logic are not agreed as to what is to be called a fallacy. The distinction which I would draw is a very simple one. I would define a fallacy an invalid argument or an argument in which the conclusion does not follow from the premisses. (Perhaps I should have written "premiss or premisses," for I see no reason why such reasonings as the following should not be classed as fallacies. All men are mortals, therefore, All mortals are men. If the country is under a tyranny it must be distressed; therefore, If the country is distressed it must be under a tyranny.) Most logicians, however, employ the term fallacy in a wider signification.

Now, in treating of valid arguments, it might appear that we had sufficiently dealt with invalid ones also. If an universal affirmative proposition (A) can only be converted into a particular affirmative (I), then its conversion into an universal affirmative is a fallacy. If a syllogism, containing an undistributed middle, or an illicit process of either the major

or the minor term (or, of course, a syllogism manifestly containing four terms) is inconclusive, it is a fallacy; and the rules for the reduction of hypothetical and disjunctive syllogisms to the categorical form will show when these latter syllogisms are fallacious. And, in fact, the largest class of fallacies is excluded by these rules, namely, what Archbishop Whately calls Logical Fallacies. Of these it is only necessary to say here that sometimes an argument, in which there are three propositions, with apparently four or five terms, will, by a mere change in the form of expression, be reducible to one in which there are only three terms, and which, on examination, will prove perfectly valid, while, on the other hand, syllogisms, which apparently have three terms only, will often turn out to have really four, and will, consequently, fall into the class of fallacies. For, in the first place, the same proposition (or the same idea) can often be expressed in very different terms, whereas in judging of the validity of an argument we must attend to the meaning intended to be conveyed, and not merely to the words conveying it. Thus take the following argument:—

No irrational agent could have produced a work  
which manifests design,  
The Universe is a work which manifests design,  
Therefore, The Universe is the work of a rational agent.

Here the reasoning is valid, for the major premiss is the equivalent of

Every work which manifests design is the work  
of a rational agent,

though, from the different mode of expression, the reader might, at first sight, think there were four or five terms. On the other hand, take the following:—

Every one desires happiness,  
Virtue is happiness,  
Therefore, Every one desires virtue.

Here we can very easily reduce the terms (apparently) to three, by reading the major premiss “(All) happiness is a thing desired by every one,” with a similar change in the terms of the conclusion. But on a closer examination of the minor premiss it becomes clear that the speaker does not

literally mean that Virtue is happiness. He intends to imply only that happiness is the *effect* or the *invariable accompaniment* of virtue, and as soon as what is meant is properly expressed, we find that there are four terms in the argument which do not admit of any further reduction. For it is evident that I may desire a thing without desiring its effects or accompaniments, and *vice versa*. The reader should be on his guard against cases of this kind. Nothing is more common with orators, or with inaccurate reasoners, than to employ the word *is*, not in its proper logical signification of identity, but to express the relation of cause and effect, or that of co-existence. So, too, the present tense is sometimes used when the past or future should have been employed in order to convey accurately the intended meaning, as in the syllogism :—

He who is most hungry eats the most ;  
He who eats least is most hungry,  
Therefore, He who eats least eats most.

Here what is meant by the major premiss is He who is most hungry *will eat* most, while the minor means He who *has eaten* least is most hungry, which two premisses lead to the perfectly legitimate conclusion that he who *has eaten* least *will eat* most. In fact, the proportion of current fallacies, which arise from the admission of inaccurate and elliptical modes of expression into arguments, is a very large one. Take the following as another example :—

Two and three are even and odd ;  
Two and three are five,  
Therefore, Five is even and odd.

Here the major premiss is false. Two is even and Three is odd, but in no admissible sense is it true that Two and three are even and odd. The reader, however, readily accepts the major premiss, because he regards it as a mere abbreviation of *two* propositions, both of which are true, and never dreams of questioning it until he finds it reasoned upon as a *single* proposition. It is, therefore, a primary rule in judging of the soundness or unsoundness of any argument, to see, in the first place, that what is meant to be stated is expressed with all the fulness and accuracy that language admits of. No figure of speech, however natural or uni-

versal, can be admitted into an argument which is to be tested by the rules of syllogism.\*

But the rules of syllogism do not sufficiently protect us against one extensive class of bad reasonings—those founded on ambiguities in the terms employed, or rather of the middle term. Owing to this, an argument may appear at first sight perfectly conformable to the rules of the syllogism, when it is really not so. This ambiguity may sometimes affect the entire proposition, but it more commonly affects the middle term only, in which case (so soon as the ambiguity is detected) the fallacy will fall under the head of a syllogism with four irreducible terms. Ambiguities are of various kinds. Sometimes the same word stands for two or more distinct ideas in its ordinary use, as happens, for example, in the case of *Light* or *Post*. Reasonings based on ambiguities, however, can deceive nobody, unless there is some connexion between the two meanings, which may lead to a confusion between them; as, for example, occurs with the term *Law*, the scientific meaning of which is not very different from its ordinary signification while the senses in which it includes and excludes what is called *Equity* are seldom distinguished except by lawyers. But where the words are not in themselves ambiguous, they may be differently employed in the two premisses, and thus become ambiguous from the context. The most common instance of this is where the middle term is used collectively in one premiss, and distributively in the other, *e.g.*,

Things which happen every day are not improbable,

Some things against which the chances are millions to one happen every day,

Therefore, Some things against which the chances are millions to one are not improbable.

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\* Another inaccurate mode of expression in common use is exemplified by the proverb, *All that glitters is not gold*. Here the real meaning is not *All is not* but *Not-all is* which is a particular not an universal proposition. Indeed it seems meant to include two particular propositions, viz. :—Gold glitters (something that glitters is gold), and other things than gold glitter also (something that glitters is not gold).

Here the term *things-which-happen-every-day* is used distributively in one case, and collectively in the other, which, indeed, also occurred in our former case of Two and three being even and odd. I think it will be found on investigation, however, that in all cases where the ambiguity is not in the middle term itself, a more accurate statement of the premisses will bring the fallacy to light. Here the premisses correctly expressed are:—

If the *same* thing happens every day, it is not improbable.

On every day something happens against which the chances are millions to one.

From which premisses no conclusion follows; for while something against which the chances were millions to one happens every day, it will be a *different* thing on each day. So again (to take another kind of ambiguity arising from the context),

What is sold in the market is eaten,  
Raw meat is sold in the market,

Therefore, Raw meat is eaten,

the conclusion is perfectly correct, but from carelessness of expression we are apt to take it as meaning not that Raw meat is eaten, but that Meat is eaten raw. The latter conclusion would not follow, unless the major premiss had asserted that What is sold in the market is eaten *in the same condition in which it is sold*. Had the argument been the following:—

What is sold in the market is eaten,  
Wheat is sold in the market,

Therefore, Wheat is eaten,

No one, I presume, would have quarrelled with the conclusion, though the wheat has to be ground into flour, and baked before it is eaten. Accuracy of expression will, therefore, reduce all fallacies (in syllogisms) to a violation of some one or more of the rules of syllogism previously laid down (including the rule against four irreducible terms), except when the middle term is in itself ambiguous, and,

even in this latter case, the same reduction can be made as soon as the ambiguity is detected.\*

Before quitting this subject, I ought, perhaps, to refer to what Archbishop Whately calls the fallacy of Paronymous Words. It arises entirely from the prevailing habit of stating arguments in a form different from the syllogistic. I have already noticed that in such cases the reasoning may be perfectly valid, though the syllogism, as expressed, contains four or five terms, because they are (with a little trouble) reducible to three. This arises not only from the employment of inaccurate expressions already mentioned, but also from the fact that words with a common etymology sometimes have quite distinct significations. Thus—

To have been on unfriendly terms with a murdered man is a *presumption* of guilt.

A B was on unfriendly terms with the murdered man,

Therefore, We may *presume* he is guilty.

Here "presumption" is used in a quite different sense from "presume," and, therefore, the conclusion does not follow. Before we "presume" that a man is guilty of murder, we

\* A syllogistic term, of course, need not consist of a single word, and the ambiguity may be in the entire phrase, and not any particular part of it. Thus:—

Meat and drink are the Necessaries of life,

The revenues of Vitellius were spent on meat and drink.

Therefore, The revenues of Vitellius were spent on the necessities of life.

Here the truth appears to be that (taking meat to mean solid food) a certain amount of meat and drink of some kind is necessary to life. No kind of meat and drink is absolutely necessary, while any kind becomes necessary *if there is no other to be had*. So far they all stand on the same footing. But the phrase "necessaries of life" has got another meaning in which "necessaries" is opposed to "luxuries," and "necessaries of life" means a sufficient amount of the *cheapest kind* of meat and drink that will support life. In the argument before us the phrase "necessaries of life" is evidently intended to be used in one sense in the premiss and another in the conclusion; in which case the syllogism has four irreducible terms. If, however, we use it in the conclusion in the same sense as in the premiss, we have a valid syllogism with a true conclusion.

must not only have some "presumption" of his guilt, but one which is sufficient to outweigh all presumptions on the other side. Such reasonings, therefore, substantially come under the head of ambiguous middle.

The result of our investigations, then, has been to add *ambiguous middle* to the classes of fallacies previously discussed in treating of valid arguments; for, of course, when an entire proposition is ambiguous, the middle term must be affected by the general ambiguity. In fact, it is then doubtful what the middle term is. We have further seen that the division of fallacies of ambiguous middle into those where the ambiguity is in the term itself, and those where it arises from the context is unnecessary, because in the latter case a more accurate mode of expression will always remove the ambiguity. Logicians, however, have so generally included two other species of arguments among fallacies, that it becomes necessary to notice them in the concluding chapter. These are the (so-called) fallacies of *Petitio Principii* and *Ignoratio Elenchi* which, it will be seen, have not hitherto been touched on.

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## CHAPTER X.

### PETITIO PRINCIPII AND IGNORATIO ELENCHI.— CONCLUSION.

ACCORDING to the view which I have taken of Logic, it treats of *conclusive* inference only. Either the conclusion is proved, or it is not proved. There is no such thing as premisses proving the conclusion to be probable. Of course if the premisses themselves are only probable, the conclusion will not be certain, and the conclusion may be false, if the premisses are so; but so long as the conclusion follows certainly *from the premisses* the *argument* is valid. We have proved that if the premisses are true, the conclusion is true, and that is all that can be effected by reasoning in the sense in which I have hitherto been using the term.

That the premiss, or premisses, involve or imply the conclusion is therefore a property of all conclusive reasoning and if we were to class all arguments which possess this

property as fallacies, the distinction between valid and invalid reasoning would be entirely lost. It may not convey any new truth to infer from *All men are mortal* that *Some mortals are men*, or to infer from *All men are mortal*, and *The Duke of Wellington is a man*, that *The Duke of Wellington is mortal*; but in no admissible sense of the word are either of these reasonings *fallacies*. There is, however, this difference between an immediate inference and a syllogism, that the former never can lead us to any new truth while the latter may. The reason of this difference is, that in the former case we reason from a single proposition, and the inference drawn from it (by conversion, subalternation, obversion, or opposition), is so clearly implied in its very meaning, that it is impossible to suppose any one who thoroughly understands the one not to admit the other. But to draw a syllogistic conclusion, it is not only necessary to have a general (or habitual) knowledge of both premisses, but also to put them together; and a great many people never put together the different portions of their knowledge, in order to see what consequences they lead to. For example, we may suppose a man to know the ordinary tests for arsenic, so as to be able to answer the question if asked at an examination, and yet not to think of arsenic, or the tests for its presence, when they are visibly fulfilled before him, and so to miss the discovery that the substance he is looking at contains arsenic. The principal difficulty in following such a book as Euclid, arises from the difficulty of bringing together different portions of our previous knowledge rapidly and clearly; and many writers would represent all the processes of Pure Mathematics as consisting only in the proper selection and putting together of the portions of our previous knowledge which are best calculated to lead to results that have not hitherto been thought of. This doctrine is indeed untenable in its full extent. No combination of our previous knowledge would give us the *constructions* which in many cases are necessary to the proof of Euclid's theorems; but where the proof does not require any lines to be drawn except those mentioned in the enunciation of the theorem the whole difficulty, either in making the original discovery, or in following the proofs, arises from the fact that the whole of our knowledge can never be simultaneously present to the mind, while the discovery, or proof, requires certain



specific portions of it, to have been simultaneously present, and thought of in conjunction.

I have made these remarks as a preliminary to considering the so-called fallacy of *Petitio Principii*, or assuming that which ought to be proved. In my view there is no such fallacy. What is sought to be proved, *must* be assumed in the premisses, or else, strictly speaking, it is not proved at all; for reasoning (as I have hitherto considered it), simply consists in showing that the premisses necessarily imply the conclusion. But though there is no such *fallacy*, as a *Petitio Principii*, there is an objectionable form of argument to which that name may be properly applied. This objectionable form consists in endeavouring to palm off as a syllogism, what is really an immediate inference, and so to induce the reader to believe that he is being led to some new truth, when, in reality, a previous allegation, or assumption of the reasoner, is merely disguised by expressing it in different terms. It would not be a *fallacy* to argue—

All men are mortal  
Some men are men.

Therefore, Some men are mortal;

but the reader would consider it absurd to attempt to prove by a syllogism what was evident to every one who understood the major premiss, and would regard the minor premiss as wholly superfluous. Now, if we bear in mind the distinction formerly drawn between analytical and synthetical judgments—or propositions in which the predicate forms a part (or the whole) of the meaning of the subject, and propositions in which the meaning of the predicate is distinct from that of the subject—it will be at once seen that no number of analytical propositions can be of any use in arriving at a new truth. They, in fact, merely explain (completely or partially) some of the terms previously used in the argument, and to one who fully understands the meaning of those terms, they are of no use whatever. Hence, if a syllogism has one analytical premiss, the conclusion can never contain any assertion which is not included in the *other* premiss, and the argument therefore is not really a syllogism, but an immediate inference, usually disguised by employing language different from that used in ordinary subalternation, conversion,

and opposition. This kind of argument, though of little use, is not in itself fallacious; but it is often used unfairly, the reasoner endeavouring to conceal his assumption of the synthetical premiss, by assiduously directing the attention of the reader, or hearer, to the analytical one. It is, therefore, a good rule in judging of arguments, to be more than ordinarily suspicious when the reasoner devotes all his attention to enforcing some self-evident truth. A *Petitio Principii* I would define as *A syllogism with one analytical premiss*. It is not a fallacy, but it leads to no new truth; and whoever doubts the conclusion, is sure (if he sees and understands it) to doubt the synthetical premiss; for the former is either a part of the latter, or else the very same proposition differently expressed.

*Ignoratio Elenchi* on the other hand, generally speaking, is a fallacy, namely, an ambiguous middle (or some other logical defect) in the *second* syllogism of an argument. It has two forms. In the first, I undertake to prove one proposition and I then prove *another* proposition sufficiently like to be mistaken for it by the reader or hearer. The second is of a similar character. I prove one proposition and in my subsequent reasonings take it for granted that I have proved a different proposition sufficiently like the former to be mistaken for it. In both cases there is one valid syllogism and another syllogism (usually implied rather than expressed) which falls within some class of fallacy previously enumerated; unless, indeed, that the second syllogism may be valid also when the truth of one of its premisses is open to doubt. To take an example from Archbishop Whately, a reasoner undertakes to show that men have not the right of private judgment, and then proceeds to prove that it is impossible that every man should be right in his judgment. He establishes this by a valid syllogism; but if asked how he argues from the impossibility of every man being right in his judgment to the inadmissableness of the right of private judgment he will have to form a second syllogism, containing either a questionable premiss or a fallacy turning on the ambiguity of the word "right." If the reasoner had adopted the reverse course and after proving that every man could not be right in his judgment assumed in a subsequent portion of his argument that men had not the right of private judgment,

he should be challenged to prove the connexion between the conclusion of his first syllogism and the assumed premiss of the following one; in doing which he would in all probability fall into a fallacy of ambiguity. These fallacies would usually become more evident if the *whole* argument (including both what was proved and what was subsequently reasoned upon) was stated in the form of a Sorites. It would then be seen at once that a link was unsupplied.

The other so-called fallacies mentioned by Logicians are mere artifices for inducing the hearer or reader to accept premisses of which there is no satisfactory proof; or to accept an alleged conclusion as a consequence of certain premisses, without examining whether it really follows from them. It is very desirable to be on one's guard against such artifices and to know a few of the most ordinary "dodges" of the kind which will be found in Whately's *Logic* and similar works. Whately, moreover, exemplifies some of them in his own person. "*As if*" is with him (and others) a favourite way of introducing a refutation of some theory by its supposed consequences or by a supposed parallel case, when it will be found on investigation that there is no relation of consequence or parallelism between the two propositions. And this leads me to observe that I believe there are fewer fallacies current in the world than is sometimes alleged. When we wish to resist the conclusion arrived at by any reasoner we must either dispute one (or both) of his premisses or charge his reasoning with fallacy. But to dispute the premisses (though it might be frequently done with success) requires not only a knowledge of the subject but frequently a good deal of patient thought, whereas a charge of fallacy can be made by any one acquainted with the rules of *Logic*, though perfectly ignorant of the facts. The most convenient mode of refutation therefore is to detect a fallacy in the argument which is done by representing its author as saying what he never intended to say or (as an argumentative writer seldom expresses all the links in his chain of reasoning at length) filling up every gap in the argument in a way that he never dreamt of. When Sir William Hamilton meets with an obnoxious doctrine in Philosophy he almost invariably contends that in "ultimate analysis" it is "self-contradictory;" and there are various other writers who adopt the same mode of confutation. It is a good rule whenever you

find a distinguished writer charged with falling into some gross fallacy to examine what he *has* said instead of what he is represented to have said, and, in nine cases out of ten, the alleged fallacy will disappear.\* He may have reasoned from false premisses and so arrived at a wrong conclusion, but the reasoning itself is usually valid. Where it is not so the most common form of error is that which has been just described as *Ignoratio Elenchi*.

Whether included under the name of Logic or not, however, there is another branch of inquiry which is necessary to complete the problem, namely, *Probabilities*. Logic, as I have expounded it, treats of conclusions which follow certainly from the premisses and the only way in which such a conclusion can be probable is that it follows from a premiss which is only probably true. But the reader will ask how do we come by the probable premiss or premisses in this Syllogism? And here it must be admitted that if we include under proof the proof that a proposition is probable, the Syllogism is not a complete theory of Proof. The certainty of a proposition may sometimes be self-evident; but its probability never can. The proposition, *It is probable that A is B*, is invariably the result of evidence, and though the probable proposition which we happen to be thinking of at the moment may be the conclusion of a syllogism (with a probable premiss) it is plain that if we go back we must at last come to a probable proposition which is not the conclusion of a syllogism, but whose probability must nevertheless have been established by evidence. This, however, would lead me into a very wide field of inquiry and one in which even the elementary principles do not seem to be fully determined. It is one moreover which has been pretty fully treated of by Mr. Mill.

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\* Except where a man has been brought up in some system of belief which he is called on in mature years to defend by argument. In this case, however good the cause may be, he frequently adopts a fallacious line of defence, or at best falls back on a *Petitio Principii*.

## QUESTIONS FOR EXAMINATION.

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### CHAPTER I.

1. State the nature and object of the science of Logic.
2. Why is it unnecessary for a writer on Logic to inquire into the relations between thought and language?
3. Why does the author believe that words are not essential to thought?
4. In what sense does he use the term "idea"?
5. What parts of speech are recognised by the logician? How are the others dealt with?
6. What is the advantage of recognising these parts of speech only?
7. Distinguish between a word and a term?
8. Logic is not the only science which requires every-day language to be reduced to stated forms before dealing with it?
9. What is a general idea? What term is opposed to it by the author?
10. To what three forms can all propositions be reduced according to logicians?
11. Define a judgment.
12. Categorical judgments (or propositions) are subdivided into four forms. By what letters are these denoted in Logic?
13. What is meant by EIO?
14. What is the proof that all propositions are reducible to the forms recognised by logicians?

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### CHAPTER II.

1. What is meant by the comprehension and extension of a term? By what other names are each of them designated?
2. Why is it objectionable to speak of the comprehension of an idea?
3. What is a definition?
4. Has every general name a comprehension? Has every general name an extension?
5. Comprehension and extension do not stand on the same footing. How are we to discover whether a name has an extension?

6. State what is asserted in any proposition with regard to the comprehension and extension of the terms employed. (That the comprehension of the predicate is—or is not—found in the extension of the subject.)

7. Show that the comprehension determines the extension. And state what a proposition asserts with regard to the comprehensions of its subject and predicate.

8. Distinguish between Analytical and Synthetical judgments. Which of them conveys real information?

9. Is a definition an analytical or synthetical judgment?

10. If all judgments were analytical what is the only book that mankind would require?

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### CHAPTER III.

1. What are the three logical elements of a categorical judgment? Does Logic admit of more than one copula?

2. How do you distinguish between the predicate and subject of a judgment?

3. How do you ascertain the quantity of the predicate?

4. What is meant by an universal or a particular proposition, or generally by the quantity of a proposition?

5. What is meant by its quality?

6. Define conversion. State how A E I and O may be converted.

7. What is subalternation? Show that it is justified.

8. What is obversion? What is conversion by contraposition?

9. Explain contradiction, contrariety, and sub-contrariety. What is meant by opposition?

10. Why cannot the fundamental principles of Logic be proved by argument?

11. Show that the only useful kind of opposition is contradiction, and give examples of its use.

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### CHAPTER IV.

1. What inferences can be drawn from the propositions A, E, I and O respectively? Why does not sub-contrariety appear in this list?

2. Show how to ascertain what inferences could be drawn if we knew A, E, I or O to be false?

3. Give examples of immediate inferences that cannot be drawn legitimately.

4. General rule on this subject? How expressed in Latin?

5. Another general rule? Prove it?

6. Why can you not infer from "*Some As are Bs*" that the other As are not Bs?

7. "Some *As only* are *Bs*" is a statement which really includes two propositions?

8. What is the rule or axiom on which subalternation depends? Why does the author object to employing the words "whole" and "part" in the statement of it?

9. Are logical terms used collectively or distributively? When a collective term occurs how does the logician deal with it?

10. Why is it misleading to say that the proposition "*Some As are Bs*" has its subject *undistributed*?

11. Ambiguity in the words *All* and *Some*. Why is *Every* better than *All* for logical purposes?

12. What is the error involved in reducing ordinary propositions to equations?

13. Singular propositions have no subalterns or contradictory? Peculiarity of the contrary of a singular proposition?

14. What other immediate inferences are admitted by some logicians? How are they best treated in Logic?

## CHAPTER V.

1. State the axioms on which categorical syllogisms depend.

2. Explain the phrases *major term*, *major premiss*, *minor term*, *minor premiss*, *premises*, *conclusion*, *extremes*.

3. Which premiss is usually written first? Is this necessary?

4. State the five general rules of categorical syllogisms.

5. What is meant by *undistributed middle*?

6. What is meant by *illicit process*? There are two kinds of it?

7. The number of universal terms in the predicates of the premisses is the same as in the predicate of the conclusion?

8. The number of universal terms in the subjects of the premisses must exceed by one those in the subject of the conclusion? Under what circumstances can the excess be two?

9. If one premiss be particular the conclusion must be particular?

10. Show that no conclusion can be drawn from two particular premisses.

## CHAPTER VI.

1. In one sense of the word "term" a valid syllogism cannot have more than three terms; in another sense it must have four. Explain this.

2. What is meant by the four syllogistic figures?

3. Where the middle term is the subject of one premiss and the predicate of the other, it is not always a matter of indifference whether the syllogism is formed in the first or the fourth figure?

4. What is meant by the *mode* of a syllogism? How is the term ambiguous? Explain the mode EIO, and the mode Ferio? The ambiguity is greater in the case of invalid modes.
5. What is the number of possible modes, including both valid and invalid ones?
6. How does the author ascertain the number of valid modes?
7. On what ground does he reject the pair of premisses IE? Prove that IEO is invalid.
8. State the eleven legitimate modes. One of them is useless. What is meant by an useless mode?
9. Show that AAI is useless in the first figure, but not so in the fourth?
10. Why do many writers reduce the number of legitimate modes to ten?

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## CHAPTER VII.

1. The general rules of syllogism consist of two kinds? On which of these are the special rules based?
2. What general rules affect terms rather than propositions?
3. The special rules of syllogism are merely cautions against three defects. What are they?
4. How do you reconcile the fact that the special rules are cautions against three defects with the fact that there are only two special rules in the case of the first three figures? (In each instance one fault is excluded by the general rules affecting propositions.)
5. State the general rules of the first three figures. What faults are each of them directed against?
6. The special rules of the fourth figure may be stated in two different ways?
7. State the legitimate modes in each figure. How many are useless?
8. What figure has no useless mode, and why?
9. Prove that AEO is either illegitimate or useless.
10. State Aristotle's Dictum. How is it applied to a syllogism in the first figure?
11. Explain the meaning of the consonants in the names of the various legitimate modes. Show how to reduce Bramantip and Camestres to the first figure.
12. How did Aristotle prove the validity of the recognised modes of the second, third, and fourth figures? To what two modes is this mode of proof inapplicable?
13. What is the meaning of the final *p* in Bramantip? This mode is not useless?



## CHAPTER VIII.

1. What is meant by a *Sorites*?
2. What are the laws of a *Sorites*? How may Aristotle's Dictum be applied to it?
3. How can a hypothetical proposition be reduced to the categorical form?
4. There are two valid and two invalid kinds of hypothetical syllogism?
5. Prove the invalidity of the latter two. What are the corresponding defects in categorical syllogisms?
6. How can you ascertain the validity or invalidity of a syllogism with *two* hypothetical premisses?
7. How can a disjunctive proposition be reduced to the hypothetical and thence to the categorical form?
8. A kind of disjunctive syllogism usually admitted by logicians is rejected as invalid by the author?
9. If this kind of syllogism be valid a disjunctive proposition is equivalent to *two* hypotheticals, and therefore to two categoricals? This is not true of the ordinary disjunctive according to the author?
10. The logical treatment of hypotheticals and disjunctives is simplified by what consideration? (The categorical equivalent is always an universal affirmative.)
11. How do you contradict a hypothetical or disjunctive proposition? (See the equivalent categorical. The contradictory will, of course, be O.)
12. What is an enthymeme?
13. Show that the following reasoning is really enthymematic, *i.e.* that a premiss logically necessary to the argument is not expressed—
 

$\frac{3}{4}$  of the army were killed.  
 $\frac{3}{4}$  of the army were Prussians.  
 Therefore some of the Prussians were killed.
14. How is ridicule an argument against the proposition ridiculed?
15. How may a question form a step in a train of reasoning?

## CHAPTER IX.

1. What is the author's notion of a fallacy? How applicable to immediate inferences?
2. Apparently fallacious reasonings are sometimes valid, and *vice versa*.
3. Give instances of false conclusions arising from inaccurate modes of expressing true premisses.

4. What class of fallacies do the rules of syllogism not sufficiently protect us against?

5. When only is the ambiguity of a term dangerous?

6. Where the ambiguity of the middle term arises from the context it can always be removed by adopting a more accurate mode of expression. Give instances.

7. What is meant by the fallacy of Paronymous words? How does it arise?

8. What is the fallacy in the following syllogism—

Meat and drink are the necessities of life.

The revenues of Vitellius were spent on meat and drink.

Therefore they were spent on the necessities of life?

## CHAPTER X.

1. Why is it wrong to class all arguments in which the premiss or premisses necessarily imply the conclusion as fallacies?

2. There is a difference between such arguments when drawn from one premiss and when drawn from two or more?

3. Error in describing Euclid (or Mathematics generally) as mere reasoning from premisses already known and admitted to results necessarily involved in them?

4. Principal difficulty in the study of Euclid?

5. Define a *Petitio Principii*. How is it objectionable as a form of reasoning?

6. What is the objection to the following argument:—

He who sinks all party distinctions for his country's good is a true patriot.

Lord Melbourne did this.

Therefore he was a true patriot?

7. Is *Ignoratio Elenchi* a fallacy, and if so of what kind?

8. What is the defect in the following argument:—

If every man insists on forming his own opinion on this subject many conflicting decisions will be arrived at.

But it is impossible that several conflicting decisions should all be right.

Therefore all men have not the right of judging for themselves on the matter?

9. Explain the nature of most of the other fallacies enumerated by logicians?

10. Why is it convenient to accuse an opponent of fallacious reasoning?

11. The syllogism is not a complete theory of proof or evidence?

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